FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

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DIARY OF CURRENT AND FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in this list:—

1932.
Dec. 30. Comrades of the R.A.F. Annual General Meeting.

1933.
Jan. 4. Women's Auto. and Sports Assoc. Dinner to Mrs. Mollison.
Jan. 6. Bristol and Wessex Ae.C. Dance at Grand Spa Hotel.
Jan. 6. No. 25 (F.) Sqdn., R.A.F., Re-union Dinner at May Fair Hotel.
Jan. 7. Reading Ae.C. Dance.
Jan. 11. B. G.A. Ball in Honour of Mrs. Mollison at Portman Rooms.
Jan. 12. "Airship Development Abroad." Lecture by Sqdn.-Ldr. R. S. Booth before R.Ae.S.
Jan. 26-28. Forest Gate Aviation Show.
Jan. 31. "Detonation." Lecture by F. R. B. King before R.Ae.S., Students' Section. Chairman, H. T. Tizard.
Feb. 1. Entries close for the Deutsche de la Meurthe Cup (Aero Club de France).
Feb. 3. Cinque Ports Flying Club Annual Dinner and Dance at Rl. Pavilion Hotel, Folkestone.
Feb. 8. "Recent Operations in Kurdistan." Lecture by Group-Capt. A. G. R. Garrod before R.U.S.I.
Feb. 10. Viceroy's Challenge Trophy Race, Delhi.
Feb. 13. "A Review of Air Transport." Lecture by G. E Woods Humphery before Inst. of Transport.
Mar. 29. "The East African Dependencies." Lecture by H. F. Melland before R.U.S.I. Chairman, Air Vice-Marshal Sir V. Vyvyan.
May 20. Kent Air Pageant and Opening of Maidstone Aerodrome.
June 24. Royal Air Force Display, Hendon.

EDITORIAL COMMENT

THE pilot looks ahead to see what lies before him, while the rear gunner gazes backwards over the tail and watches the landmarks which have been passed and left behind. In the last issue of the year 1932 FLIGHT takes the same view as the gunner, and looks back at the doings and achievements of the past twelve months.

Two events seem to stand out above the rest, one a feat of flying and the other a triumph of design.

The Rear Gunner's View

We allude to the winning for Great Britain of the altitude record by Mr. C. F. Uwins in a Vickers "Vespa" with Bristol "Pegasus" engine, when he reached a height of some 44,000 ft.; and to the production of the Short R.6/28 flying boat driven by six Rolls-Royce 825-h.p. "Buzzard" engines. The winning of the height record in 1932, after winning the speed record in 1931, is a feat of which Great Britain may justly feel very proud. We should very much have liked to add to these two the long-distance record; but the winds have been unkind and the Fairey (Napier) long-range monoplane has waited vainly at Cranwell through the period of two moons, and now the attempt has been abandoned for this year at any rate.

Progress in the development of flying boats is a subject which has always been very near to the heart of FLIGHT, and we venture to think that no more beautiful aircraft has ever been seen on the water or in the air than the new six-engined Short flying boat. It marks a great step forward, and will, we are convinced, lead to still greater advances in the future.

For the rest we propose to place the year's events in the three categories of Service, Civil, and Technical. Let us give pride of place to the Royal Air Force. For them the year has been one of steady development rather than of sensational achievement. With the re-equipping of Nos. 29 and 56 (Fighter) Squadrons with the "Bulldog," all the squadrons of Air Defence of Great Britain, excepting only the night bombers, are now equipped with up-to-date types of aircraft. No new type of night bomber has

yet been served out, but those who will may draw conclusions from the bestowal of the name "Heyford" on the Handley Page H.P. 38. A new aerodrome has been opened at Abingdon, Biggin Hill has once more become a home of fighter squadrons now that the reconstruction work has been finished, and Kenley has been vacated for reconstruction in its turn. Tours have been undertaken by No. 14 (Bomber) Squadron in East Africa, by No. 8 B.S. from Aden to Cairo, and by No. 205 (Flying Boat) Squadron from Singapore to Darwin. Air Exercises in the summer tested the organisation for air defence on the west of London. The period of Short Service commissions has been extended from five to six years. An Indian Air Force has officially come into being. The year ends with much talk of air disarmament which does not seem likely to lead to very much, though it will, we hope, put an end to the fear and the idea that an air force exists only to slay civil populations with poison gas.

Turning to civil flying, we must start by repeating much of what we said last week about Imperial Airways. The southern section of the Cape route has been opened, and the route down the Persian Gulf has been changed from the Persian to the Arabian shore. Branch lines have been started to connect with the Imperial trunk airway in Tanganyika and Kenya. In India the arrangement by which Imperial Airways operated the route Karachi-Delhi for the Indian Government came to an end, and this service was taken over by the Delhi Aero Club. As soon as the south-west monsoon was over, the firm of Tata Sons Ltd. commenced a service with "Puss Moths" to connect with the Imperial Airways machines at Karachi and to carry mails between that city and Bombay and Madras. This example of private enterprise is very gratifying, the route flown is long and crosses the range of the Western Ghats, and the cities served are the two most important in India, saving only Calcutta and the political capital of Delhi. This effort of the Tata firm is a very important event.

In Australia too, important events have been taking place, and again we must repeat what we have described in recent issues. It has been decided that an Australian company shall carry air mails between Darwin and Singapore, to connect at the latter place with Imperial Airways. Internally one airway is to run through Queensland to Cootamundra, with a branch airway to Brisbane, while at Cootamundra the mails will be put on trains for Sydney, Melbourne and Adelaide. Another trunk airway is to run down the West Australian coast (as at present) to Perth. At the same time the Perth-Adelaide air route, which was instituted to carry mails from the steamer port of Fremantle to the railway system of the south-eastern corner of the continent, will be abolished as being no longer of any use. Travellers between Adelaide and Perth will regret this, as the railway journey over the Nullabor plain is far from attractive, but they are not sufficiently numerous to justify the expense of carrying on the air service. A subsidised air service will be opened between Melbourne and Tasmania, which ought to have a very useful future before it.

In civil flying at Home the framing of the rule known as A.N.D. 11 gives us additional cause to regret the death of Sir Sefton Brancker, whose administration as Director of Civil Aviation was always governed by common sense and active help for all genuine aeronautical progress. We feel sure that such a regulation could never have been drawn up in his day. The sooner it is cancelled and forgotten the better. During the year the old system of subsidies for the flying clubs came to an end, and a new one was drawn up. The club movement is full of life, and the number of private pilots and privately-owned aircraft continues to increase in a satisfactory way.

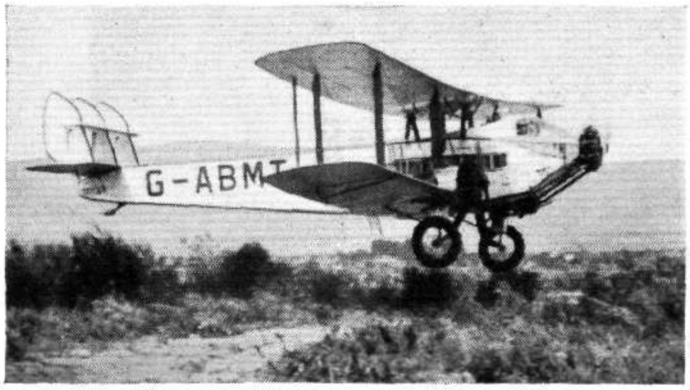
To leave British affairs for a moment, we cordially approve the action of the United States Government in forbidding attempts to fly the Atlantic except with special permission of the U.S. Government. It may be a restriction of freedom, but that freedom had been terribly abused; and it is to be hoped that the tale of Atlantic flying tragedies will not be so long in the future.

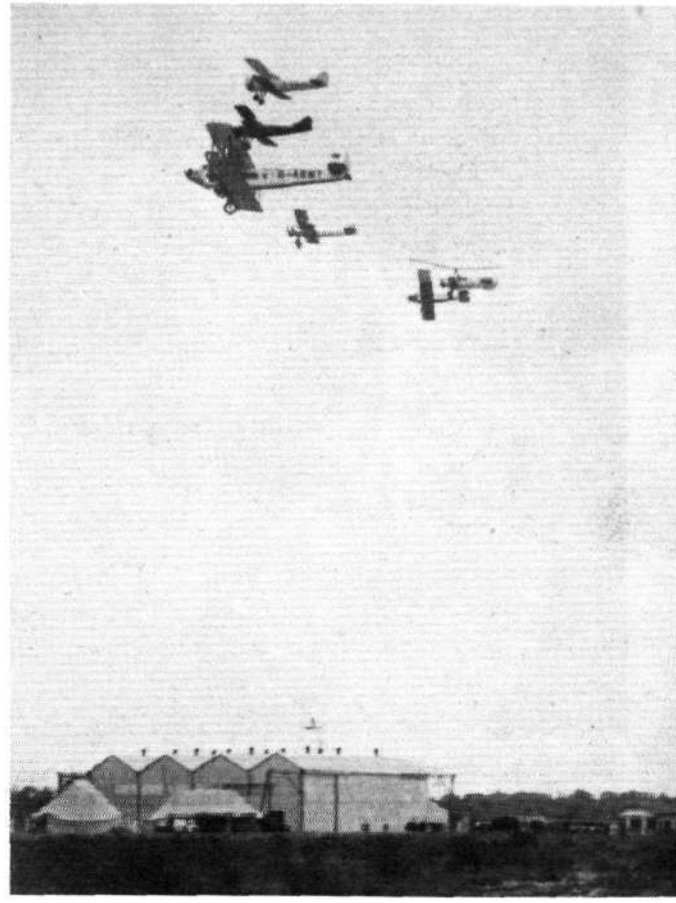
There have been a number of great flights during the year, both by British subjects and by foreigners. The most notable British flights were the record flights in light aeroplanes of Mr. C. W. A. Scott from England to Australia in 8 days 20 hr. 27 min., Mr. Mollison's flight across the Atlantic from East to West, and the two flights of Mrs. Mollison from Croydon to Capetown and back.

We have mentioned the Short flying boat as the chief technical event of the year. Other productions of importance are the Monospar, the Percival "Gull," the Gloster Troop-carrier, the Fairey night bomber, the Armstrong-Whitworth "Atalanta," and the De Havilland "Dragon." The Autogiro C 19 received its certificate of airworthiness. New engines introduced during 1932 were the Pobjoy "R," the Napier air-cooled "E. 97," the inverted "Hermes IV" and the "Gipsy Major."

The year has seen the passing of some notable personalities in the flying world. Two pioneers have gone in M. Santos-Dumont and Mr. Eustace Short. Rear-Admiral and Air Vice-Marshal Sir Godfrey Paine has also died, and the list also includes Group Capt. Pink, William Brock (who piloted Mr. Schlee across the Atlantic in 1927), H. G. Watkins of the British Arctic Air Route Expedition, and Lieut. Neri, of the Italian High Speed Flight.

Such, in brief, is the record of 1932. Soon we shall be looking forward to the prospects of 1933.





THE CIRCUS AT THE CAPE : Six of Sir Alan Cobham's machines flying in formation, led by the D.H.66, over Cape Town are shown above. On the left, the D.H. 66 lands, apparently in rough ground, at the Cape Airport. Actually, the surface of the aerodrome is quite smooth.

SIR ALAN COBHAM IN SOUTH AFRICA

APART from his many other exploits, Sir Alan Cobham seems to have had a particular bent towards Africa—in fact, he even says " Africa has always been my favourite Continent." And now he has come back for the fifth time to enter upon his campaign to popularise flying in South Africa—in the same way as he did so successfully in England when his " Air Circus " carried 250,000 passengers and the interest stimulated thereby was to some extent responsible for the making of aerodromes by many municipalities. Sir Alan anticipates that this campaign will cost £400 per day to run, so he does not expect to make much profit, the sole purpose being to popularise flying there.

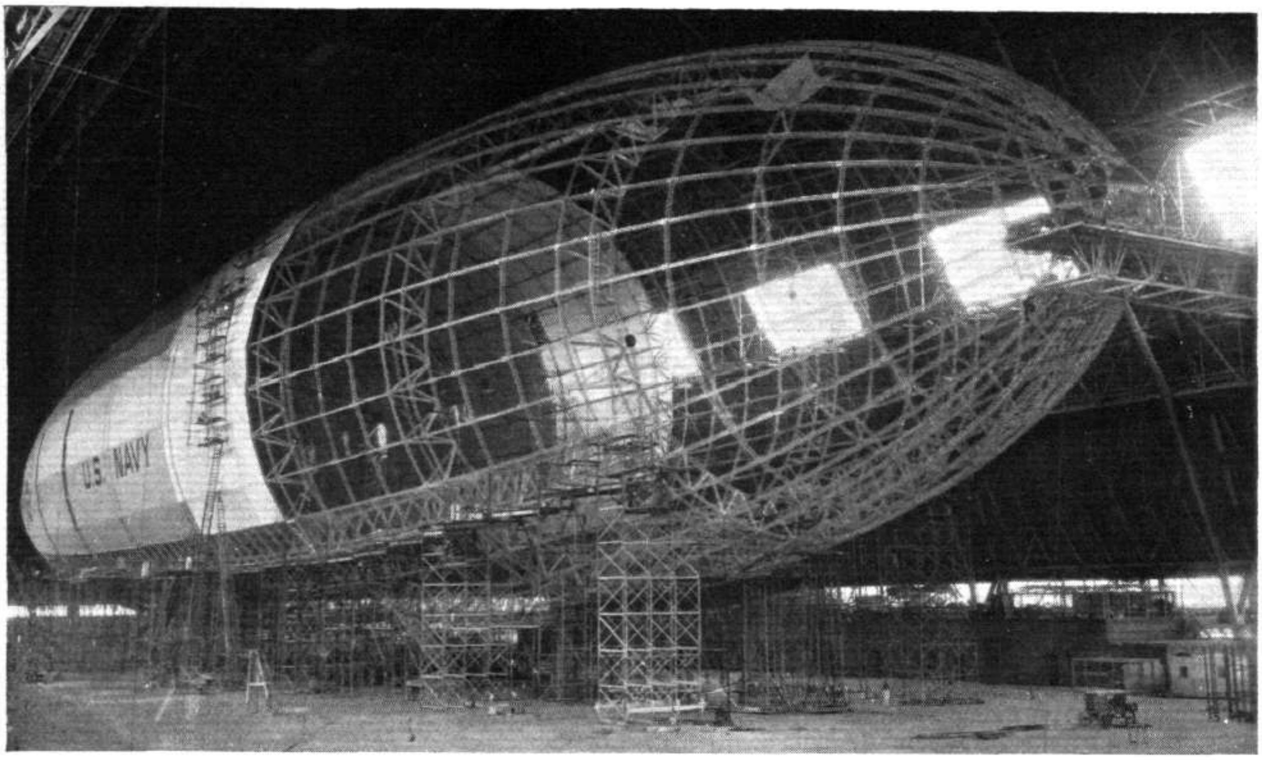
The personnel who are conducting this tour include Sir Alan and Lady Cobham, Mr. D. L. Eskell (general manager), Flt. Lt. C. F. Turner-Hughes (aerobatics pilot), Flt. Lt. H. C. Johnson, Flt. Lt. H. Lawson, Flt. Lt. A. H. C. Rawson (Autogiro), Mr. C. W. H. Bebb, Mr. M. Hearn and Mr. Ivor Price (parachutist).

Six aircraft are employed, including a de Havilland 66 " Hercules " *City of Cape Town* (bought from Imperial Airways, Ltd., and used for passenger flights), an Autogiro G-ABGB (demonstrations and passenger flights), an Armstrong-Whitworth A.W. XVI (aerobatics), and three Avro type 621 " Tutors " G-ABZP, G-AARZ, G-ABZR (chiefly for passenger aerobatics and trial lessons). The outfit is completed by a Public Address apparatus in its own van and a very comprehensive fleet of six-wheeled 2½-ton Leyland lorries and Siddeley saloon cars to deal with all the equipment during the many moves from place to place.

An excellent start to the tour was made at the Cape Town Municipal Airport on December 1-3, when spectators had the opportunity of seeing an excellent programme, which included all the usual events to thrill the vast crowds. For Cape Town the chief novelties were the Autogiro and the A.W. XVI, as well as the chance to make "aerobatic flights " in the " Tutors " or flights in such a big machine as the D.H.66. The efficient advertising before the displays was no doubt a great help to its success, but above all a competition organised by the *Cape Times* for free flights in the " Hercules " brought the show very much in the public eye.

From Cape Town the Circus has moved on to visit a large number of cities and country districts throughout the whole of South Africa.

The Avro 621 " Tutor " and the Autogiro of Sir Alan's Circus flying in typical Cape Town scenery.



The U.S. Airship *Macon* under construction at the Goodyear factory at Akron is rapidly nearing completion, and is expected to be out by next March.

AMERICA'S GIANT AIRSHIP NEARLY READY

IN less than six months another leviathan of the sky, the U.S.S. *Macon*, sister ship of the U.S.S. *Akron*, will take to the air, according to officials of the Goodyear Zeppelin Corporation, who are building this second airship at Akron, Ohio, U.S.A. The Goodyear Zeppelin Corporation is a subsidiary of the Goodyear Tyre & Rubber Company, whose British factory is situated at Wolverhampton.

About four-fifths of the aluminium alloy skeleton has received its outer cover, five of the eight engines have been installed, the control car is nearing completion and will be attached to the hull shortly, two of the big fins are about to be raised, the aeroplane compartment bridge for the five scout planes the ship will carry has been lifted to position, fuel tanks and ballast bags are being placed, and the windlasses and other equipment for operating the mooring cables are being built into the *Macon's* nose.

While no definite date has been set for the first trial of the *Macon*, indications are that the initial tests will begin in March, 1933. As viewed from the exterior, the *Akron* and *Macon* will present the same general appearance, as they are identical in size and shape. The position and size of control surfaces and control car have not been altered, and the power plants with the tilting propeller feature are employed on the *Macon* as on the *Akron*.

However, with the experience gained from the flights of the *Akron* since it was put into service just a year ago, it has been possible to improve the design of many installations in the *Macon*, and such changes have been incorporated wherever simplification or weight saving was possible.

When the *Macon* is finished, the Goodyear-Zeppelin Corporation's contract to build two giant airships for the United States Navy will have been fulfilled, and, already, unusual interest is attached to the plans of Goodyear to construct commercial air liners larger than the *Akron* and the *Macon*.

P. W. Litchfield, president of the Goodyear-Zeppelin Corporation, points to the fine records of the U.S.S. *Akron* and the *Graf Zeppelin*, along whose lines the giant liners of the upper air will be constructed.

"The flight of the U.S.S. *Akron* from Lakehurst to Los Angeles was remarkable," said Mr. Litchfield, "because of the fact that the craft battled one of the worst storms ever known in the mountainous regions of the south-west; yet it scaled the mounain peaks and arrived on the coast without injury.

"The *Graf Zeppelin* in the last four years has made nearly 300 flights with passengers, including a series of regular scheduled trips between Germany and Brazil. Flights also have been made by the *Graf Zeppelin* to Ireland, to Spitzbergen, and to Egypt. The reliability of this advanced mode of travel has been thoroughly demonstrated, for, during all of these flights, there has never been an injury sustained by any passenger or any member of a crew."

Air League of the British Empire: Reconstituted Committee

As a result of the manifesto on British Air Policy issued on November 8 on behalf of the Royal Aeronautical Society, the Royal Aero Club and the Air League of the British Empire (published in Flight for November 17 last), the Air League have invited each of the other two bodies to nominate two members to serve on a reconstituted Executive Committee of the Air League. The invitation has been accepted, and the Royal Aeronautical Society have nominated Mr. Griffith Brewer and Mr. Lawrence Wingfield, the Royal Aero Club, Lord Gorell and Mr. W. Lindsay Everard, M.P. The new committee met on December 15 under the chairmanship of Maj. Gen. J. E. B. Seely, who was unanimously elected to fill this office, Capt. F. E. Guest, M.P., the former chairman, remaining on the committee as deputy-chairman.

Deutsch de la Meurthe Cup

The late entries for this contest close on February 1, 1933. The date of the contest has been fixed for May 28, and the course of 200 kilometres starting at Etampes will include the aerodromes at Orleans and Chartres. Changing of engines during the contest will not be allowed. Full particulars can be obtained from the Royal Aero Club.

Douglas Thorburn Returns to England

Many of our readers will be interested to learn that an old friend, Douglas Thorburn, has returned to England from the Riviera, where he has lived during the past 12 years, and is now settling down in London. Douglas Thorburn was an active and enthusiastic worker in the cause of aviation during the early days of flying, and among other activities was associated with Lord Wakefield and also was responsible for many bright contributions to Flight.

For the Training of Ground Engineers

Where and how to get sound and adequate training is always a problem. In the case of aircraft engineering, however, the new scheme outlined below provides a ready solution. This training scheme has been laid out by the College of Aeronautical Engineering in collaboration with the Directorate of Aeronautical Inspection and should therefore "fill the bill" perfectly.

A NEW and apparently very sound scheme indeed has been inaugurated by the College of Aeronautical Engineering at Chelsea, which provides for a scheme of training designed to raise the status of the Ground Engineer and provide an adequate supply of well-trained youths for the aircraft industry. In its essentials it consists of a scheme of training whereby the College at Chelsea co-operates with well-established firms in the aircraft industry, supplying them in the first place with youths who have already received a sound engineering training at the College, and who will therefore be of some considerable use to the co-operating firms during the final part of the training.

The career of an aeronautical engineer is one which should be attractive to the better type of public schoolboy, because aviation is a growing industry and one which offers great scope for initiative and personal success. At the present time, however, its size is small, and it is essential therefore, that the number of youths taken into the industry should be limited to the requirements. This is necessary because the demand for the better class of Ground Engineer cannot but be comparatively small for some time.

The scheme starts when the students are enrolled for a probationary term at the College in Sydney Street, Chelsea. During this time they are tested, and those who are considered unsuitable, are told so quite candidly, so that both their parents' money and their time may not be wasted in further training. This then ensures that only suitable youths are carried in the College for the full period.

For the next twelve months their work lies mainly in the engine overhaul shops, where a large stock of all sorts and descriptions of aircraft engines is carried. They overhaul these, actually doing the work themselves, so that they become thoroughly conversant with the engines in every way. During this time they also go to lectures in conjunction with their shop work, and are, as well, taught fitting, machine shop work, testing materials, foundry work, engine testing, carburetter work, welding and machine drawing. At the end of each term the standard they have to attain is rigorously maintained by both oral and written examinations.

Working on engines in this manner has the advantage of the fact that the students are enabled to overhaul the engines from the beginning to end, and actually to run them up on the test bed, thereby becoming conversant with engine overhaul from every point of view, a matter which they would not be permitted to undertake on airworthy engines at an aerodrome or in a factory.

After examination at the end of this twelve months the students who pass satisfactorily are transferred to Brooklands, where for a minimum period of six months they are engaged on rigging, power plant installation, dope shop practice, instrument and compass maintenance and adjustment, daily and periodical inspection, overhauls and final inspection after C. of A. overhauls and re-fits, and care and maintenance of wireless equipment. At the end of this period the examination is similar in every respect to that laid down for the Air Ministry Ground Engineer's Licences "A" and "C," and those who pass obtain the College's Intermediate Certificate.

A further side of the training during the 21 months they are at Chelsea and Brooklands takes the form of theoretical training in aero engines, materials of construction, wireless, electricity and magnetism, theory of flight, navigation and meteorology, and aerodrome management, while those students who, prior to joining the College, possess a sufficiently high standard of mathematics, may study and sit for the examination for the Associate Fellowship of the Royal Aeronautical Society.

So far the training is as has hitherto been carried out at the College, and it is now that the new part of the training comes into effect. After gaining the Intermediate Certificate the students next pass to an aircraft or aircraft engine manufacturing firm, where they undergo a scheme of training definitely planned and carried out with the co-operation of the College. By this means they get actual experience of work on aircraft and engines in daily use. The students may spend the whole of the remaining nine months of their training with one company, or they may pass from one company to another, according to the facilities available and to the licences they require. For those students who wish to gain their "B" licence on aircraft, it is necessary to spend a longer period with the selected firm.

In the case of manufacturing firms of aircraft or engines the students will work to a special schedule drawn up by the College in collaboration with that firm, while in the case of students working at operating companies, their schedule will be as follows:—

Maintenance of rigging and flying controls under operating conditions ; particulars of controls incorporating differential action ; locating defects, etc., that are encountered during operations ; recording angles of incidence, dihedral, stagger, and tail setting, etc. ; methods of effecting repairs and replacements, including information on the processes involved ; method of examination of aircraft after a heavy landing ; diagnosing of faults experienced during flight and methods of correction ; checking of

THE AIRCRAFT ENGINE SHOP AT CHELSEA : In this shop embryo ground engineers are instructed in the art of pulling aircraft engines to pieces and then assembling them in such a way that they will work ! Engines of all the best known types are to be found here. (FLIGHT *Photo.*)

instruments; cable splicing; lubrication of aircraft controls, etc.; compass adjustment and swinging; flow tests; checking and mounting of airscrews; periodical and complete overhauls to aircraft; welding and tank repair; engine, periodical and complete overhauls; engine, daily maintenance; ignition timing; method of tuning and carrying out of adjustments before flight; particulars of ground r.p.m.; maintenance and function of gauges; wiring for earth system, and method of checking; taxying aircraft into position and tying down.

A log will be kept of each student's work at these co-operating firms and a report will be forwarded to the College as to the ability of each student and the recommendation or otherwise for his sitting for the Air Ministry Licence examination. It will be seen that this scheme ensures that firms will get students who are already, so to speak, "worth their salt," in that they have attained the knowledge required for both the "A" and "C" licences before they go to those firms. They will have been trained to a point where they will be capable of carrying out a large amount of the work expected of Ground Engineers. They will be thoroughly conversant with general and aeronautical engineering practice, and in many cases have an "A" pilot's licence for flying. In some cases they will have passed the Associate Fellowship examination for the Royal Aeronautical Society, but in all cases they will certainly possess a standard of knowledge which should enable them readily to assimilate the advanced and specialised training which they will get when working at these co-operating firms. All these facts will thus obviate the necessity of the firms taking on raw youths who will be comparatively useless to them for some considerable time.

It is obvious that this carefully planned training being, as it is, complete, is preferable to the usual apprenticeship system wherein it often rests with the pupil himself whether or not he benefits from his time in the works. If he is keen and ensures his own transfer to various departments, he probably does learn quite a lot, but very often he does not come under men who are interested in teaching him, and the lack of a co-ordinated system of instruction and training seldom provides successful results. A further advantage of this scheme is that it will give students an opportunity to prove their usefulness to the firms at which they finish their training, so that these firms will thereby have good opportunities to select the best for addition to their staffs. It would appear that this scheme should go far to raise the status of the engineers entering the aircraft industry and of checking the entry of numbers of young men into it, who are not really fitted for the work. The number of applications being received at Chelsea augurs well for the scheme.

Strangling Private Flying

(*Continued from p.* 1174.)

THE "approved" aircraft firm is one recognised by the Air Ministry as being capable of designing and building aircraft which in the views of the Air Ministry are reasonably safe, and which (much more important) conform to all the pet theories and regulations in force at any given time. The "approved" firm is a fairly recent institution. Previously every aircraft firm was under suspicion, and treated as if it would, given the slightest opportunity, foist on an unsuspecting public aircraft which might or might not be conscientiously built up, but which would certainly not meet with official approval in every detail unless a close watch was kept upon the firm. All drawings, etc., had, of course, to be submitted to Farnborough for inspection, and if these were approved, the firm might proceed with the construction, provided that Government (*i.e.*, A.I.D.) inspectors examined and passed everything that went into the machine.

The system worked fairly well for a time, until the number of aircraft intended for the private owner began to reach fairly large proportions. It was then found that the extra expense and trouble of inspection, which was additional to and to some extent a duplicate of the inspection system which the firm itself maintained, had become such as to impose too great a burden on the aircraft constructor. The Air Ministry expressed willingness to reconsider the subject, and as a result of deliberations, committee meetings, and what not, the "approved" firm scheme came into being. By this, such aircraft firms as had succeeded in convincing the Air Ministry of its abilities were given a "Resident Technical Officer," who was, in fact, the Air Ministry representative on the spot. In other words, the "approval" was only a qualified one, and did not extend to trusting the firm entirely. It was not regarded as good enough to "approve" such firms only as could be depended upon to build their machines strictly in accordance with approved drawings, to put into them only such materials as had been agreed upon for the different parts in question, and to see that the workmanship was everywhere of first-class quality. That would have been the sensible thing to do, and then there would have been some meaning in the expression "approved." As it is, the "approved" firm is rather on a footing with the occupied zones during the years following the war. They *might* be good, and they *might* behave, but at any rate precious good care was being taken to see that they *did* behave and that they *were* good.

There are two classes of "approval," one for inspection and one for design. A firm may be approved for either or both. As things are at present, to be "approved" both for inspection and design is, presumably, the greatest degree of trust which the Air Ministry can bestow.

The "unapproved" firm is one which has not attained to either of these positions of respectability. The firm must have all its work examined and inspected by accredited representatives of the Air Ministry, and the cost of such inspection is, of course, borne by the firm, whose products in consequence are of necessity made that much more expensive.

In our issue of December 8 we referred to a third class, the "disapproved" firm. Strictly speaking, this class does not, we believe, include any firms, but more correctly speaking is composed of individual experimenters who, often through sheer ignorance, get brain waves and proceed to build their own crazy machines, quite oblivious of the fact that they may not take their contraptions into the air without first obtaining the permission of the Secretary of State for Air, even if the flights (if any) are made over their own property and a hundred miles away from the nearest habitation. Presumably the idea behind this regulation, if there ever was any real idea behind it, is that the State must protect not only people on the ground but also the inventors themselves. The safeguarding of people and property on the ground is a praiseworthy ideal, and few will quarrel with it. But why the State should feel called upon to protect aircraft experimenters against themselves is not at all clear.

How it has worked

In looking on the situation as it exists to-day it is very necessary to bear in mind that when regulations were planned and drafted soon after the war, no one could foresee the amazing way in which private flying has developed in Great Britain. Regulations were drawn up with commercial flying in mind, and not until long afterwards did it become obvious that a much clearer distinction should be made between aircraft flying "for hire or reward" and aircraft privately owned and flown.

No one would, we think, advocate that commercial aircraft should be freed from all official control. When a machine is being used on a regular air route for carrying paying passengers, those passengers are entitled to feel that their safety is being looked after as far as possible. In all other forms of transport there are official regulations to be complied with where "Hackney Carriages" or passenger vessels are concerned. But for small private aircraft there seems to be no more reason for all this government control than there is for private motor-cars.

In fairness to the Air Ministry departments concerned, it should be realised, and frankly admitted, that the Government supervision during the years following the war have had beneficial effect. British aircraft have achieved a reputation abroad which has been of very considerable value. But the time has now come, we feel, when a change would be to the advantage of everyone concerned.

The present system of Government inspection, of Government regulations, of Government "bossing," has now definitely become a brake on progress. And when you come to think of it, the very elaborate and costly machinery which we have built up has not after all guaranteed the safety of aircraft. Machines conforming in every way with the Farnborough Bible have broken their wings in the air. The fact that they carried the official Certificate of Airworthiness did not save them. Not that one would expect omniscience or infallibility from Government officials any more than from other mortals, but the whole vast machinery, set up and maintained at great cost, should represent some sort of guarantee. If it does not do so to a reasonable degree, it can only be regarded as an extravagant form of insurance in which the premium paid is out of all proportion to the benefits.

It is not very easy to convey in a short space an adequate idea of the hampering effect which all these Government regulations have had. To appreciate it one would have to be a constructor with many years' experience of trying to design and build private aircraft in spite of these Government regulations. Perhaps the position may best be explained by saying that they are in the form of innumerable "pin pricks." Each one is not, perhaps, in itself of any great importance, but the cumulative effect is definitely not only irritating, but actually harmful, in that it causes delays and extra expense.

Even a so-called "approved" firm suffers, mainly because it is "approved" in name only and not in fact. It is being supervised by a bureaucracy which has no interest in, and consequently but little understanding of, the commercial side. When anything goes wrong with an "approved" firm's machine, official instructions are issued for certain modifications to be made, not only in all subsequent aircraft of the type, but in those actually in use. If the firm in question is unfortunate enough to have its machines scattered all over the world, the tracing of them and the carrying out of the modifications is a very difficult and costly business. And often it will be the case that the firm itself could have schemed out a modification which would have been in every way as satisfactory, but which would have been far less expensive.

To show the extent to which the unfortunate manufacturer is handicapped, even when theoretically "approved," one could quote numberless examples. It may be, for instance, that he has found that in one of his types a certain member is strong enough to do its job, but that it is a little too flexible. He may decide to put in a strut to steady it. Although obviously the addition of the strut can only tend to make the machine safer, the machine will be declared unairworthy because the strut was not shown on the original drawings and that therefore the machine is not in strict accordance with the basis upon which the Certificate of Airworthiness was granted. Sometimes the R.T.O. (Resident Technical Officer) will take it upon himself to pass the machine, but more often he refuses, and then there is a delay until the procedure of getting official approval from headquarters has been carried out.

The present modifications system has become so difficult that it is no exaggeration to say that it constitutes a danger. The delays and troubles entailed in getting modifications passed are such that they may well deter a firm from making modifications which the firm knows to be desirable, but which do not happen to have been called for by the Air Ministry. For instance, experience might show that a modification of a certain part would be an improvement. The part may be fully up to strength, and may comply with all Air Ministry requirements, but it just so happens that the particular usage it gets causes failure. The modification proposed strengthens the part, and increases the safety of the aircraft in every way. Now let us examine what the procedure is when getting the proposed modification through.

Let us assume that the firm is a fully "approved" one, *i.e.*, approved for design and approved for inspection. First drawings of the modification are prepared by the firm's "approved" design department. Then the design is stressed by the firm's "approved" stress department. Then the part is made in the firm's "approved" workshops and inspected during and after manufacture by the firm's "approved" inspection department. Finally the part is put on a machine and tested in flight by the firm's "approved" test pilot. Everyone agrees, the R.T.O. and A.I.D. included, that an improvement has been made, and it might be imagined that that was that. Not a bit of it. The machine, with the admitted improvement, cannot be cleared without the preparation of an Addendum to the Type Record, and application has to be made to the Air Ministry. A fee of one guinea must be forwarded with this application, and the Air Ministry will subsequently make a further assessment of the fee to be charged. This in spite of the fact that all the work has been done by the firm, at no expense whatever to the Air Ministry. The real objection is that a delay of several days will occur before the Air Ministry's "official" approval can be obtained. In the meantime it is quite conceivable that a sale has been missed, all for the sake of red tape. And the whole elaborate system does not constitute a safeguard. In fact, the reverse. It is quite possible for a firm to turn out a machine which complies fully with Air Ministry requirements, but which is unsafe, or at least unreliable, in some particular respect.

Perhaps a constructor who has a number of types in operation is suddenly struck with an idea for some simple "gadget," such as a new type of engine silencer. Now, in the ordinary course of events, the firm will have a demonstration machine which is used for giving shows at meetings, for giving trial flights to potential customers, and so forth. The obvious thing would be to put the silencer on the demonstration machine for a thorough test, but that would make the machine "unairworthy," because the book of words says that another type of silencer is fitted on that particular machine. Consequently the constructor is practically compelled to keep an experimental aircraft merely to try out such new ideas.

How those responsible for drawing up regulations are constantly on the look-out for directions in which they can close in the net is shown by a rather trivial example. For years it has been the custom with most firms to send their machines up for the C. of A. flight after the first doping, and before final painting. This meant that the machines were without their registration letters. Suddenly one day instructions were sent out that this practice must be discontinued, and that machines must carry their registration letters during the C. of A. flights. No valid reason was given, and no case was quoted of this small privilege of not painting on the registration letters having been abused. No firm had sent out machines on cross-country flights without its registration letters, and no harm whatever had been done. But the fiat went forth. Firms now have either to finish the machines completely before sending them up for the C. of A. flight, with the result that when they are ready for the purchaser they do not look quite "brand new," or else the registration letters must be put on the first coat of dope, when their subsequent removal entails trouble and expense. The matter is trivial, certainly, but provides a good example of how Government red tape can cause quite unnecessary irritation.

On the design side the machinery which has been established is having effects the magnitude and extent of which are quite incalculable. The system of imposing Government regulations to cover everything is definitely killing all initiative. Designers are forced to proceed on recognised lines, as any departure is too expensive in time and money, and the new generation of draughtsmen and designers is developing, or has already developed, the departmental mind. The yardstick by which the design of any part or fitting is instinctively measured is not "is it good?" but "is it according to the 'book of words'?" The results of this frame of mind becoming general cannot readily be assessed in terms of cash, but they are very considerable, and may well be more serious than those of the more tangible phases of the situation.

The practice of having to have machines tested at Martlesham is also open to criticism. No one can admire what the Martlesham pilots have done, and are doing, for British military aircraft more sincerely than does Flight. As we have previously stated, to be able to say of a military aircraft that "Martlesham is pleased" is just about the highest praise of a machine's performance and general handling which it is possible to quote. But, on the face of it, it is a little absurd that a machine like the Lowe Wylde 10-h.p. "motor-assisted glider" should

compulsorily have to be tested by the same Government pilots who have the task of testing the latest multi-engined night bomber. Martlesham is fundamentally a military station, and it is inevitable that its pilots should become steeped in the military atmosphere, and should come to think in terms of high-performance military aircraft. Martlesham would not be Martlesham were it otherwise. No one doubts for one single moment either the ability or the scrupulous fairness of the Martlesham pilots. No one has ever heard a word whispered against them. But to legislate for them to have to test any little cheap low-power single-seater or two-seater that comes along is rather as if a bicycle firm was compelled by Government regulations to have each of their "push bikes" officially tested by Sir Malcolm Campbell. Sir Malcolm has something else to do, and so have the Martlesham pilots. And the bicycle firm could not afford such tests. Neither can the civil aircraft industry.

Frequently it will happen that a new low-powered civil machine is ready to go to Martlesham for tests. The weather may be such that several days must pass before the machine can be flown to Martlesham. When it does arrive there, the weather may turn bad again, or pressure of work may prevent tests from being made for another few days. But let us say that the machine has been tested and passed by Martlesham, and has been flown back to the maker's works by the maker's pilot. Can he begin to give delivery to clamouring clients? He cannot. Ten days to a fortnight will elapse before the official report of Martlesham goes through the Air Ministry and the actual Certificate of Airworthiness is finally obtained. All this applies, of course, to a new type of aircraft only. But it has happened before now that a maker has decided to install another engine than the one originally used. The engine most likely has its Certificate of Airworthiness, but the machine must go to Martlesham again for tests with the new engine. And so once more precious time is lost.

The cumulative effects of all these restrictions, regulations and official interference is delay and expense. Machines cost much more than they need do. They are no whit better or safer than if they had been designed and built with nothing but the maker's reputation to back them up, and very often they are worse because they are compromises between what the constructor would like to do and what he feels is most likely to find official approval.

The Remedy

And what is the answer? We realise that it would probably be a matter of difficulty to get a unanimous decision. But in broad outline it might be found in freeing private aircraft entirely from all Government control and interference. Machines might be classified according to weight, all private aircraft under a certain weight to be released from Government control.

There are doubtless those who will argue that this would leave unscrupulous constructors free to foist unsafe aircraft on to the public. Our answer to that is that this could very easily be taken care of. Compulsory insurance would be one very good safeguard, as no insurance company has ever been accused of reckless optimism. Backing that up we should have the constructor's regard for his reputation. No firm which had more than about three machines of one type break in the air would be likely to sell another of that type until a very convincing demonstration had been given to show that the weakness had been cured.

It may be argued that the insurance company would be as difficult to deal with as is the present Air Ministry system. Frankly, we do not believe it. An insurance company has a very direct financial interest in seeing as many safe machines as possible in the air. The Air Ministry has no such financial interest. And a firm which is accustomed to doing business on business lines is likely to be quicker in its decisions than a Government department concerned solely with seeing that the list of regulations is added to periodically, and that the regulations are obeyed.

SAYING HELLO ! TO THE PEAKS : New low-wing, all-metal, twin-engined Boeing bomber caught against the impressive background of Mount Rainier, 14,408 ft. above sea level. Seven of these planes, hailed as the fastest of their type in the world, are being built for the U.S. Army Air Corps by the Boeing Airplane Company of Seattle.

The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

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CONTENTS

THE PARIS AERO SHOW

By H. J. Pollard, Wh.Ex., A.F.R.Ae.Soc.

At an aircraft exhibition, as at exhibitions organised by other trades, the object of the exhibitors as a whole is to show that they are a progressive industry, and the object of an individual exhibitor is to demonstrate that, since the last exhibition, he has made greater progress than his trade rivals. The chief task of the trade visitor then, is to form an opinion as to what advances have been achieved. A cursory glance round the Paris Salon might have given the impression that progress during the past two years was small, but a carefully detailed inspection of the exhibits left one with the final conviction that definite progress can be reported.

The editor has already given figures showing the ratio of biplanes to monoplanes, etc. It is sufficient to state, therefore, that the use of monoplane structures is greatly on the increase. During the past two years there has been a considerable increase in the amount of flying in France, and one assumes that the difficulties associated with "laminar" lifting surfaces have been overcome, and consequently that sufficient knowledge is now available regarding the behaviour of this type of structure to ensure the safety of aircraft of the monoplane type. Of the monoplanes on view about half were of the full cantilever type (see Flight, November 24, page 1104), whilst of the fuselages about half the total were of *monocoque* construction.

About fifteen of the monoplanes on view were of the low-wing type; it was, therefore, surprising to find a retractable undercarriage fitted to *one* land machine only—leaving out of account the two amphibians. This was on the Blériot 111 Mark 5, a machine fitted with an undercarriage of a similar type to that shown at the 1930 Exhibition, but according to information supplied, a more forward position on the wheels is now obtained by inclining the hinge pins on which the leg is slung. One wheel was shown up and one down, and with the former the underside of the wing appeared to be "cleaner" than previously. It is understood that further improvements in the details of the component and of its operation are anticipated. It is clear that the Blériot Co. consider the fitting of this particular undercarriage well worth while. The speed of the machine with the wheels down is stated to be 88 per cent. of the speed with the wheels fully retracted. The fitting of such an undercarriage would, therefore, seem to merit serious consideration. Of course, the low-wing monoplane type of aircraft is the only type that can be considered as suitable for such accessory gear. It is usually stated that the increased weight associated with such an undercarriage greatly offsets its advantage. That, however, is extremely doubtful, since the increase of weight need not be more than 20 per cent. of the weight of the undercarriage. The real point at issue is, what advantage has a retractable undercarriage over a properly faired one. The answer to that question will probably be that there is not much in it, taking account of everything, *i.e.*, weight difference, risk of mechanical breakdown, forgetfulness, etc.

The retractable undercarriage shown two years ago on the three-engined Couzinet 33 has been abandoned. Actually, the wheels were not fully retracted but merely pulled up and left half projecting in the wing-propeller slipstreams. Very little reduction in drag could be obtained in that way, and the Couzinet 33 is probably a case in which a properly faired fixed undercarriage, attached to a low-wing monoplane, is likely to be better than any other arrangement. Each case must be taken on its merits, but where an undercarriage can conveniently be retracted, a better aeroplane should be obtained by its use, and in the case of several types of aircraft exhibited, it seemed possible for such an undercarriage to have been embodied in the designs.

After noting, in several cases, indifferently faired undercarriages, attention was next directed to the lifting surfaces, and here the progress made since the last exhibition did not appear to be very appreciable.

The R.W.D.6 (Warsaw) was the only aircraft having a movable slot. This cabin machine had several features that will be touched on later.

To the Potez 43, fixed slots were fitted along the length of the wing, while on the Bernard cabin

machine, fixed slots, apparently about 30 in. long, were seen secured near the wing tips. The reason why extended and proper use of this wing device is not made in France does not concern us here.

Whilst the use of slots appears generally to be neglected, the use of trailing edge flaps has greatly increased, and the use of servo strips on control surfaces was more in evidence at this Exhibition than before. The "follow-up" aileron strips of the Polish cabin machine appeared to have been designed during the original lay-out of the machine, and not added as an afterthought. A good deal of thought has evidently been given to the design of the P.Z.L. machines and from this point of view they deserve a high place in the order of merit of the aircraft shown. Two years ago adverse comment was made regarding the probable weight of the wings due to the shape and method of supporting the spars. On this occasion a spar was exhibited by itself, and on handling it one had no hesitation in saying that judged by English standards of spar weight, taking both upper and lower wing spars together, for similarly sized aircraft, the member was decidedly heavy. For reasons of strength it could not well be otherwise. The weight of the complete machine is, however, the thing that matters, and from the following figures, taken from the P.Z.L. catalogue, it will be gathered that the structure weight of the P9 was not unduly large. The figures refer to the Gnome-Rhone "K9" or "Mercury IVa."

Dry weight (including engine, prop, etc.)	... 2,270 lb.
Fuel ...	... 539 lb.
Military equipment...	... 440 ,,
Total	... 3,249 lb.

Top speed (sea level), 187 m.p.h.
Speed at 13,000 ft., 218 m.p.h.
Endurance at cruising speed, $2\frac{1}{4}$ hours.
Wing loading, 16·8 lb./ft.^{2}

The sea level top speed of the Skoda "Jupiter" is 175 m.p.h. and speed at 13,000 ft. 197 m.p.h., the all-up weight in the later case being slightly less than the above. Thus the weight of a monoplane structure is once again shown to be not much in excess of similarly-sized machines having biplane wings. The reason is that in the monoplane it is easier, due to the larger and more regular changes in the stresses in the spars, to develop a system of laminar construction giving a structure of fairly uniform stress, at any rate much more uniform than is possible in the spars of small biplane wings, in which the load variation is erratic. In other words, whilst the advantage of distance between wings in resisting bending is lost as against biplane construction, it is always possible to utilise the material in cantilever wings more economically than in biplane wings.

A strict comparison of these Polish aircraft with similar English aircraft is not possible, since they are not built to the same strength requirements. They may be equally strong in the air, but it is inconceivable that the Polish undercarriage could withstand the side load condition imperative for Air Ministry stressing. The elimination of such cases in stressing must have a beneficial effect on the structure weight. The stressing case in question is, in my opinion, however, not one to be ignored, even if, after two or three years' flying, no accident through sideways collapse of an undercarriage has occurred.

As to the details of the machine, the wings are built from duralumin strip and sheet, the section of the spar being as indicated in Fig. 1. This calls for no special comment. The web was of plain sheet, about 16G., and reinforced at intervals with vertical stiffeners. These stiffeners were also attached to the flanges as shown in the sketch, while light angle strips (*a*) were secured to the spar flanges between the vertical stiffeners. These strips are probably used for the attachment of the skin. Graduations in spar area were made through the use of different lengths of flange plates and angles (*b*) and (*c*) as indicated. The external support was attached to the spars via a fitting of the type shown, this being bolted to the web.

The exact form and method of fixing ribs to the Polish spars cannot be described, but use was doubtless made of the above-mentioned web stiffeners. There is never any difficulty in the assembly of such parts, the task being to make the best choice from the many ways of assembly that are obviously possible. As to the wing covering of these two machines, in one case a plain duralumin covering was used and in the other the sheeting was ridged, in the manner introduced by Wibault a few years ago. The covering of the "ridged" wings was also very slightly corrugated, and this observation may conveniently introduce a note on metal covering which it is appropriate to include at this point.

The utility of the covering material as a means of giving maximum torsional rigidity to a structure is beyond dispute. Sufficient stiffness may possibly be obtained by other means, but never for the same weight of material as by rigid covering.

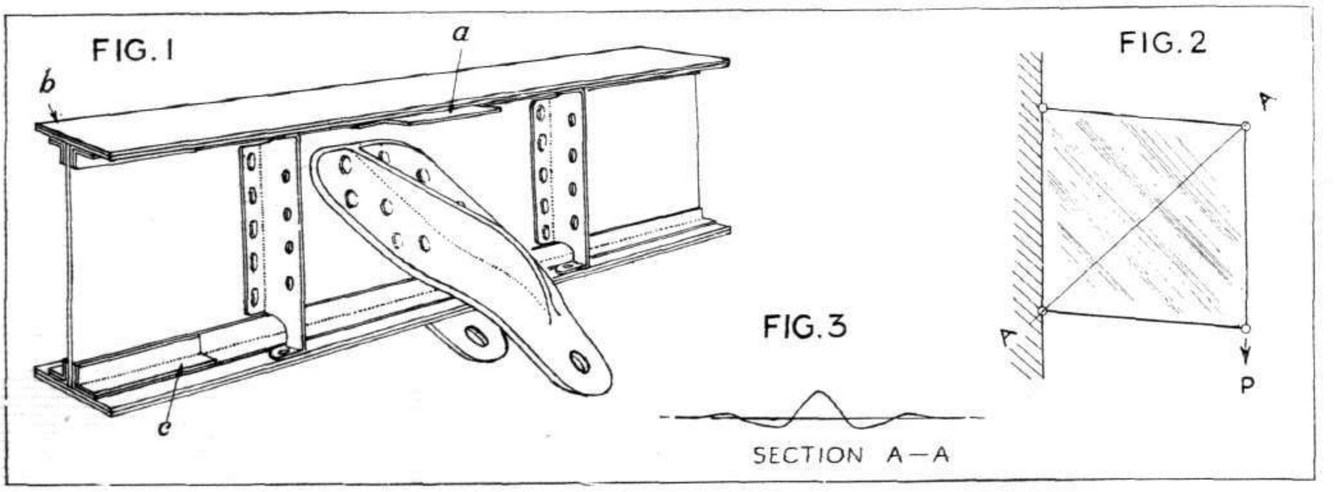


FIG. 1 FIG. 2 FIG. 3

It is most probably true to say that a metal-covered frame has never been considered as more economical from a strength-weight viewpoint than a fabric-covered girder construction, at any rate for small- and medium-sized aircraft. It has been shown mathematically that a "rigid" braced panel is lighter than an otherwise similar panel, wire-braced, but the thinness of panel required in the case of a lightly-loaded frame is altogether smaller than can be considered commercially,

even if very thin panels were available at a commercial price. But for large frames having heavy shear loads, such is not the case. Thus, in general, it may be said that at the present time, for lightly-loaded structures, fabric covering is the more economical, whilst rigid panelling can be used economically where the shear loads are large. There may be, and probably is, an intermediate class of craft in which plywood covering may be used more economically than either. The number of machines of medium size in the Show which had plywood panelling seemed to support that view. In the case of cantilever wings, however, where torsional stiffness and strength are of about equal importance, the use of rigid covering must receive every consideration, and reasonable sacrifices in weight for small aircraft appear to be fully justified. Before delving further into this subject, the reader should recognise that the desire for great torsional stiffness has been the spur behind the development of rigid-covered parts, and not the economy of weight that might be effected by its use.

The problem before the designer is the development of economic stresses in the skin under forces in the plane of the covering. In the case of a girder member the problem is easy. The load on the member is known. If the shape of the member renders the mathematical determination of its strength an impossibility, or if uncertainties arise, then the member is put in a testing machine, the necessary observations as to its strength and stiffness under load are recorded, and one or two such tests may cover the whole wings of a machine. In the case of the panel-braced frame, curved or otherwise, the problem is nothing like so simple (apart from the difficulty of making a few panel tests representative of a complete *monocoque* body). Consider a simple sheet, loaded as shown in Fig. 2. Under quite small loads the panel deforms, wrinkles appear in the manner indicated by the broken lines, whilst a section of sheet viewed at A—A takes the form shown in Fig. 3. By the use of stiffeners secured to the sheet, the formation of these wrinkles can be delayed. Within certain limits this wave formation is elastic, and the flat surface of the sheet is restored on the removal of the load. The question at issue is what degree of elastic deformation can be permitted on the surface (body, wing or other component) of an aircraft so covered, *i.e.*, what depth of elastic wave is to be considered the maximum. Obviously plastic deformation could not be permitted, and it would appear that the answer to the question will only be found through prolonged actual use and experience with this class of structure.

The best sections to use for the framing, the best disposition of these parts, and best interconnection combined with the most economical thickness of material may, and probably will be determined in the laboratory. Doubtless such experimental results will subsequently be verified mathematically. The case of the plain sheet has already been exhaustively examined by H. Wagner. The static loads at which buckles, etc., appear may be accurately predicted by experiment and theory, but the essential question as to what elastic deformation can safely be allowed will only be settled by users and operators. This is analogous to the old question of structural flexibility. Many an aircraft has attained a bad reputation, though perfectly airworthy, by a definite lack of torsional stiffness in the fuselage or tail, and the same thing would inevitably happen if portions of covering of wing or fuselage were seen to pucker under varying loading conditions. Only experience will show to what extent this can take place without causing trouble. At present, when the panel-braced structure, particularly in metal, is a comparative rarity, this puckering is not unduly criticised, but in the future, when many different types and methods will render comparison easy, this non-scientific matter of appearance will be a matter of first importance in design. It seemed that this factor was, apparently, already anticipated to some extent by several French constructors, notably Wibault, who had spaced his internal reinforcements, particularly in the wings, extremely close together. No measurements were made, but the free panel area did not seem to be more than about 3 in. by 3 in.

The question of reinforcement is also bound up with external appearance from the point of view of disguising initial buckles in the sheet, as well as bad appearance due to the formation of the elastic waves previously mentioned. Stiffening of sheets against local handling must be kept in mind also. How much the spacing of stiffeners is bound up with stress requirements, and how much with other considerations, one is unable to say, but the stiffener spacings on the Wibault wing-covering agreed, approximately, with that already established as necessary for the development of the yield strength of the material used as panel-bracing in a plane frame when subjected to, and reinforced against, shear loads applied in the plane of the frame.

The provision of a panel of the correct thickness and properly reinforced for sustaining the shear load is, of course, only part of the problem. Direct loads have also to be supported, and this matter likewise has so far received little attention. The only published literature on this subject that the writer has knowledge of is a paper by Capt. A. B. Miller, entitled "The Effective Width of a Plate supported by a Beam," published by the Institution of Civil Engineers (Publication No. 83). It is understood also that papers bearing on the subject have also been presented to the Institution of Naval Architects, but references are not available. It is stated in the above paper that ". . . . it appears to be the usual practice to take 40 to 80 times the plate thickness as the effective width . . . ." that is, to the constants for the framing members is added the moment of inertia, etc., of the above width of plate, taken about the appropriate axis. Taking a mean figure of 60, *i.e.*, 30 times the thickness on either side of the centre line of the frame-member, we see then that the development of high stresses in approximately flat covering is a hopeless proposition. The weight and amount of work involved in fixing the necessary stiffness puts such a design out of court. Another aspect of the problem is, however, the extra strength or reinforcement that the covering gives to the stringers, and from that consideration the use of rigid covering has been proved to be a practicable proposition.

Undoubtedly the lightest and most effective method of reinforcing a sheet against shear, and particularly against longitudinal forces, is by corrugation. It has, however, been definitely established that deep corrugations, even those parallel to the direction of flight, are detrimental to performance, while small corrugations cannot be of much assistance from the strength aspect. Such corrugations, one imagines, were introduced into aircraft at the exhibition for the purpose of disguising initial buckles, and usually they were ineffective in doing so. It is unlikely that such creases would affect the performance of the aircraft, least of all those on the Nieuport-Delage, which might have been $\frac{1}{4}$ the depth of those on a Junkers. What is continually in dispute regarding the matter of increased drag due to non-plain surfaces are the ridges often used for convenience in manufacture. As already stated, the P.Z.L. exhibited one set of wings having ridges of the Wibault type and one plain set. Information was furnished that the difference in performance was very small indeed; consequently to split what difference there was and still retain ease of fabrication of the wing, it had been decided to use ridges on the underside of the wing only, which appears to be good common sense.

The use of deeply-corrugated coverings is not obsolescent, although no aircraft so covered were exhibited. For slow-flying aircraft, say up to 125 m.p.h. or so,

corrugations such as the Junkers could have no very detrimental effect on performance, but they cannot be entertained for fast machines.

As a final remark on the subject of plain *versus* corrugated covering, it should be said that whilst failure of a plain sheet is preceded by much preliminary waving, failure of a corrugated sheet similarly loaded is instant and decisive. A crumpling of the sheet across the corrugations, similar in effect to the complete collapse of an ordinary wing spar under load, takes place. Consequently no time need be wasted in dispute as to the load at which failure occurred. As indicated above, in the case of the braced plain frame, usually no such decisive failure occurs until the sheet tears. Whether or not this matter of decisive failure is or is not a point in favour of the corrugated sheet is a matter left to the judgment of the reader.

Methods of securing wing and fuselage coverings will —*inter alia*—be dealt with in the next article.

(*To be continued.*).

LIGHT AERO ENGINE-AIRSCREW COMBINATIONS

By W. R. ANDREWS, A.F.R.Ae.S.

(*Continued from page* 85.)

Part 2.—The effect of varying engine size and r.p.m. at constant B.H.P. (fitted to the Monoplane of Part 1)

The engine used as a basis for this part of the investigation is No. 2 of Part 1, *i.e.*, the one running at 2,000 r.p.m. To increase the engine size the number of cylinders is increased to 9, giving a cylinder capacity of 156.9 cu. in.

The decrease in engine size is obtained by making a 5-cylinder engine of the same unit cylinder capacity.

The following table gives the details of the three engines considered.

TABLE 4.

Engine No.	No. of Cylinders	Capacity, cu. in.	Normal b.h.p.	Normal r.p.m.
1*a*	5	87·2	39·1	1,393
2	7	122	39·1	2,000
3*a*	9	156·9	39·1	3,184

The range of r.p.m. is much less than that of Part 1, but since we only wish to show the effect of r.p.m. that does not matter.

In Part 1 the aim was to arrive at a peak in the performance curve at high r.p.m. In this case the peak in the performance would be obtained at very low r.p.m., much lower than that for which any practical engine would be built.

The limitation of the engine would be size and weight and, of course, cost, but this last is beyond the scope of the article.

As in Part 1, the weights of the engines, fuel and airscrew are not considered in the first place, and the gross weight of our aircraft is again taken as 800 lb.

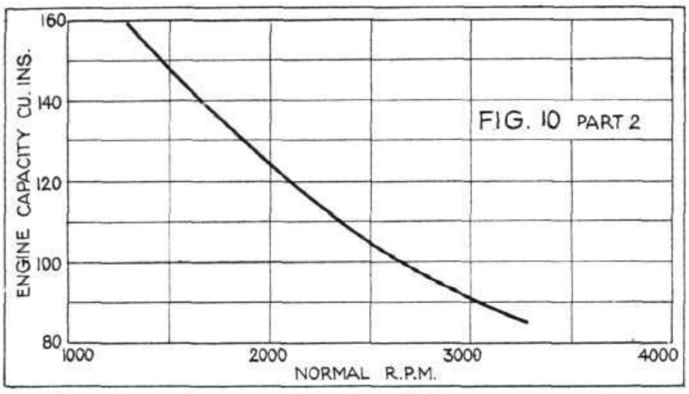
The drag of the three arrangements will be slightly different, owing to the change in frontal area.

To the first degree of approximation the drag of a radial air-cooled engine fitted with Townend Ring can be expressed as:—

$$D\ (100\ \text{m.p.h.}) = C^{2/3}\left[\cdot 475 + \frac{8\cdot 65}{(N_c + 2)^2}\right] \quad \dots\dots\dots \quad (7)$$

where C = Cylinder capacity cu. in.

N_c = Number of cylinders.



Capacity and r.p.m. of engine of 39·1 normal b.h.p.

This result is mainly dependent upon the experimental data given in R. & M. 1267 (Ref. 6), where it is shown that as the number of cylinders increases the effect of the Townend Ring becomes more pronounced.

In other words, two engines with the same Townend Ring diameter but with different numbers of cylinders will have almost the same drag.

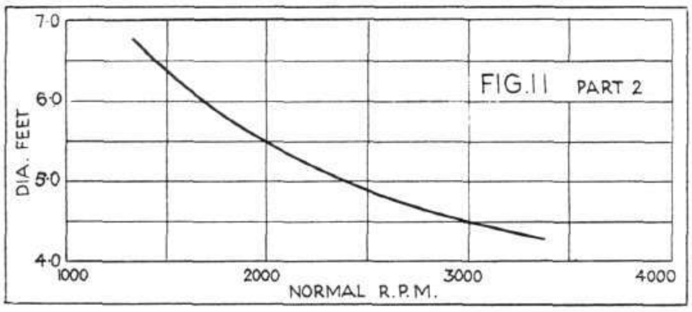
Using equation 7 gives the following drag figures:—

TABLE 5.

Engine No.	Capacity, cu. in.	Drag in lb. at 100 m.p.h.
1*a*	87·2	12·7
2	127	14·3
3*a*	156·9	15·9

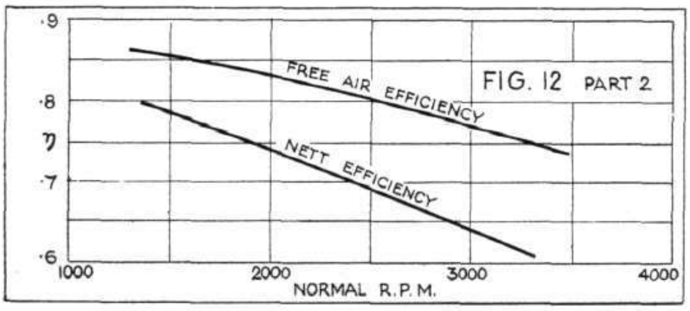
The difference is only ±1.6 lb. from the engine No. 2. The t.h.p. required to overcome 1.6 lb. drag at 100 m.p.h. is 0.4 h.p., which amount is almost negligible.

The t.h.p. required for level flight will be taken in the first instance as in Part 1.



Airscrew Diameter.

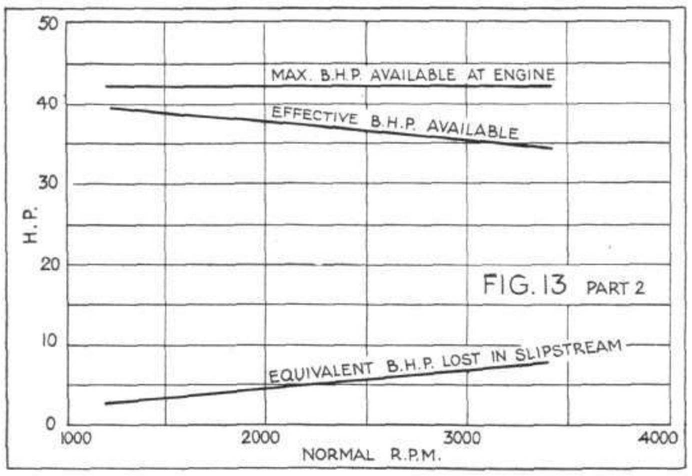
The airscrew diameters are given in Fig. 11. Even over this range of r.p.m. the airscrew diameters vary approximately a foot from that for engine No. 2. In



Effect of r.p.m. on maximum efficiency.

no case is the loss due to slipstream as great as the 6,000 r.p.m. case of Part 1.

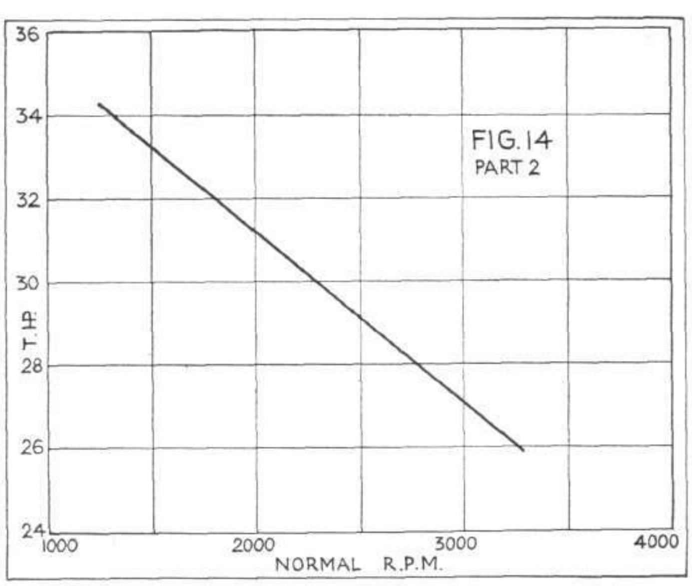
The free air and net efficiencies are shown in Fig. 12. There are indications of a peak in the efficiency curve



Work Analysis.

at some r.p.m. less than 1,000 r.p.m. No case was considered running such a low r.p.m. on account of engine size.

The work analysis is shown in Fig. 13, which shows an almost straight line slipstream loss over the range. It is to be expected that as the r.p.m. is increased above 3,000, the slipstream losses would increase in a bigger ratio than the r.p.m. Although these losses appear to be almost a straight line, that at 1,400 r.p.m. is 3 h.p.$_0$ and at 2,800 r.p.m. 6.5 h.p.$_0$.



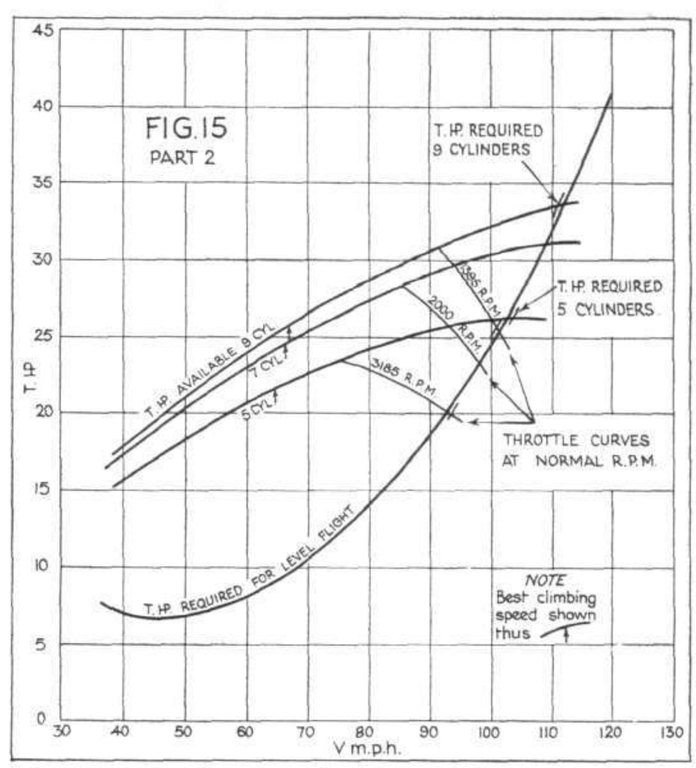
Thrust Horse-Power available at Top Speed.

The final net t.h.p. available for propelling the aeroplane is shown in Fig. 14. The gradual drop in effective power with r.p.m. is well illustrated and needs no comment.

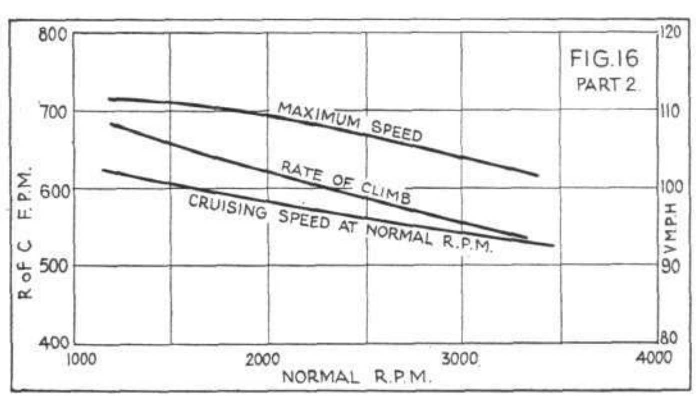
Fig. 15 shows the t.h.p. available and required for the three engines. The effect of the different drags for the engines is indicated by short lines at the points of interest. At climbing speed this effect is negligible.

The performance deduced from Fig. 15 is shown in Fig. 16. It is of interest to note that at the same gross weight the climb with the 9-cylinder engine is about 120 ft./min. better than the high-revving engine with 5 cylinders. For any very light aircraft the limiting size of engine must necessarily be the one giving the minimum rate of climb. If there is also a limit for the b.h.p. of the engine, then the one giving that power at low rates of r.p.m. will stand a better chance of filling the bill than one running at higher r.p.m., even after allowing for the different engine weights.

In this Part the variation of m.p.g. is less pronounced than in Part 1. (See Fig. 17.) Based on a range of



Effect of Engine Size on Performance with 39·1 b.h.p. Engine. Gross Weight of Aircraft 800 lb.



Performance.

400 miles the weight of the engines and fuel alone are as follows:—

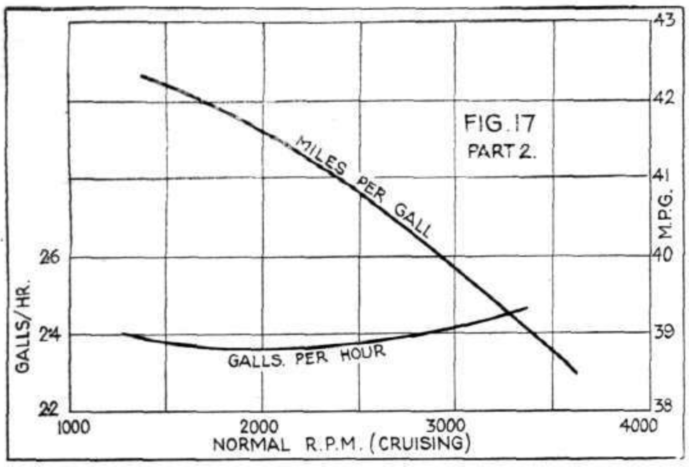
TABLE 6.

Engine No.	Engine Weight	Fuel Required	Total Fuel + Engine
	lb.	gall.	lb.
1*a*	89	10·4	169·3
2	115	9·6	188·9
3*a*	140	9·45	212·7

From this it would appear that the high-revving engine is a more favourable proposition, but it must be remembered that the rate of climb is less than for the other cases.

From Fig. 8 (see AIRCRAFT ENGINEER, December 1, 1932) it is found that to give the same rate of climb as 1a, the 2,000-c.c. engine must be run at 1,750 r.p.m. normal. The top speed would be 106 m.p.h. and the cruising speed 96 m.p.h. as compared with 103 and 94 m.p.h. respectively for engine 1a. The m.p.g. at 1,750 r.p.m. is also increased to 45 m.p.g. as compared with 38.3 m.p.g. for engine 1a.

The weight of engine + fuel is reduced to 183.5 lb. so that on this score the higher-revving engine wins



Fuel Economy.

slightly at the expense of fuel economy. With fuel at 1s. 7½d. per gallon it is estimated that the extra fuel economy of 7 m.p.g. would more than compensate for the small increase in engine price due to running at 1,750 instead of 3,200 r.p.m.

R. & M. 1267

Reference 6.—Reduction of drag of radial engines by the attachment of rings of aerofoil section, including interference experiments of an allied nature, with some further applications.—H. C. H. Townend, B.Sc.

(*To be concluded.*)

CEILING CAPACITY AS A MEASURE OF PERFORMANCE

By CLIFFORD W. TINSON, F.R.Ae.S.

IN dealing with aeroplanes fitted with supercharged engines, sea level loses its former significance as a datum level to which to refer performance, and because different engines have various rated altitudes, the rated altitude is not a suitable datum level for this purpose.

Speed-range, rate of climb, and ceiling all depend on the excess power available over that required, so that an improvement of performance, whether attained simply by an increase of engine power, or by reducing air resistance by better streamlining, or by improving the thrust horse-power available by gearing the air-screw shaft or otherwise, may be related to the height of the absolute ceiling.

The *ceiling capacity* of an aeroplane, therefore, embraces certain aerodynamic qualities in addition to its relation to the face values of power loading and wing surface loading.

The increase of speed from ceiling down, provided that the airscrew be of what may be termed average form, is substantially similar for a wide range of wing and power loadings, whilst the slope of the rate of climb curve, as it leaves absolute ceiling (taking this point as origin instead of sea level, as formerly), is intimately connected with ceiling capacity.

By making absolute ceiling the datum level of reference, and drawing curves to show the appreciation of performance from ceiling downwards, using such portion of them as lies between ceiling and rated altitude, it is possible rapidly to forecast the performance of an aeroplane at the altitudes which matter, irrespective of the relation between rated altitude and sea level.

Further, the method should improve the accuracy of obtaining climb times between heights nearing the ceiling, since the errors are convergent towards the ceiling instead of divergent from the ground. With the usual method, the accuracy is greater where the order of climb time figures is small, and less where the climb times are double figures, so that a comparatively small percentage error may make a difference of perhaps a minute to climb to 20,000 ft., whilst the same percentage error makes no appreciable difference low down.

By working the opposite way, the error will be relatively greater in the times between heights *furthest* from ceiling, at altitudes at which the performance is generally relatively unimportant.

When it is inconvenient to make complete calculations for the estimation of aeroplane performance, an approximation may be made from formulæ connecting wing surface loading and power loading.

The basic formulæ for maximum speed, maximum rate of climb, and absolute ceiling are of the following form:—

$$(1)\ V\ \max = K\left(\frac{\text{Wing loading}}{\text{Power loading}}\right)^n$$

$$(2)\ V_c\ \max = \left(\frac{K_1}{\text{Power loading}}\right) - \left(K_2\sqrt{\text{Wing loading}}\right)$$

$$(3)\ H\ \max = 40{,}000\ \log_{10}\left(\frac{K_3}{\text{Power loading}\times\sqrt{\text{Wing loading}}}\right)$$

From the rate of climb, times to heights are obtained from

$$(4)\ T = \frac{2\cdot303}{r}\log_{10}\left(\frac{A_2}{A_1}\right)$$

where r = the slope of the rate of climb curve, and A_1 and A_2 are the rates of climb at heights h_1 and h_2 respectively.

These formulæ are discussed in a number of works, among them being "Airplane Design," by Warner, the "Handbook of Aeronautics," and the current issue of the "Air Annual of the British Empire."

The constants K, K_1, K_2 and K_3 are based, naturally, upon results of actual performance, and the published values are representative of average design. The values vary, however, not only with type of aeroplane, but with different authorities.

For example, in the speed formula, the value originally given by Warner to K as representative generally of the (then) average design is 124. Liptrot's average would be 125, as he gives the value 120 at one end for boat seaplanes, rising to 130 for single-seater fighters, these being the average figures in their respective classes. Another authority gives 126 as the average.

Gassner, however, in an article published in "Aviation" in June, 1932, gives the value of K for a single-seater fighter as 137, rising to 150 for what he calls a "refined" aeroplane of similar type.

(*For a number of years* FLIGHT *has been in the habit of using the Everling "High-speed Figure" $\eta/2k_D$, which is in effect identical with Diehl's formula quoted by Warner, but which is directly comparable with top speed, etc., in the metric system as used by Continental journals. For example, an Everling high-speed figure of 26, which is approximately the highest achieved by a normal aircraft,* i.e., *one not fitted with retractable undercarriage, corresponds to a value of K = 156 in Diehl's formula* $V_{\max} = K\sqrt[3]{P}$; *K*=138 *corresponds to* $\eta/2k_D$ *of* 18.—ED.)

It is clear that the determination of a suitable value in any particular case demands some experience, and in addition a mental picture of the degree of streamlining or cleanness which the above values represent.

Further, if K has an original value of 137 in a particular case, and by better streamlining the value can rise to 150—roughly 15 miles per hour faster—the power and wing loading being unchanged, then the values of K_1, K_2 and K_3 in the climb and ceiling formulæ must change in sympathy, for less power is required, rendering more available for climb, and a higher ceiling will be attainable for the same face values of power and wing loadings.

In the ceiling formula, the average value of K_3 given by Warner is 88, but here again the values must vary

over an appreciable range. It is certain that many modern aircraft have absolute ceilings corresponding to higher values of K_3 than this, 110 being a figure which by no means represents the upper limit.

For example, a standard air-cooled single-seater fighter with complete service equipment and direct-drive airscrew may have a ceiling corresponding to a K_3 of 90. Removing the generators, navigation lights, etc., may raise the figure to 95, but fitting a Townend ring and wheel fairings, etc., and obtaining relatively more thrust horse-power by gearing the aircrew may raise the figure to as much as 105. The same machine fitted with a retractable undercarriage would have an appreciably higher value.

Now, if it is possible, by experience and the association of certain values with certain classes and sub-classes of aircraft, to fix upon a value for K_3 in the ceiling expression which shall be within, say, two or three per cent. of the value which ultimately proves to be the correct one (which is substantially the same degree of accuracy as is necessary for the estimation of the constant K in the speed formula), it is possible to make use of curves having absolute ceiling as datum level. Such curves would show the capabilities of an aeroplane in terms of its ceiling capacity.

If an aeroplane is capable of reaching a higher ceiling, either by virtue of a better power loading ratio, or by being relatively cleaner so that more power is available for climbing, its speed range will be greater and its maximum speed higher in consequence.

Plotting the curves in this way has an advantage where supercharged engines are concerned. When naturally aspirated engines were the only type in use, it did not matter whether the performance were calculated from sea level up or from ceiling down, as both were fixed datum levels, but with supercharged engines sea level cannot be used as a datum for comparison of performance, and is not replaced by rated altitude as a datum level because at the present time the height of the rated altitude varies with engines designed for different duties. Absolute ceiling then becomes the reference time, and general curves showing the appreciation of performance from ceiling down may be constructed and used for aeroplanes fitted with engines of any rated altitude, provided that the only portion of the curves used is that which lies between absolute ceiling and rated altitude.

For the rest, the performance between sea level and rated altitude may be ascertained by the former method if it is required, to find the time interval to reach rated altitude, the speeds below it being of little consequence.

On reaching absolute ceiling, all aeroplanes, of no matter what wing and power loadings, are on a common basis, inasmuch as all of them have but one level flying speed, zero rate of climb, and one value of r.p.m. (the throttle being fully open, of course, to maintain the height considered). Therefore, the "performance" at absolute ceiling resolves itself into a determination of the ceiling height and the ceiling speed.

The estimation of the height of the absolute ceiling has been referred to above, and the conclusion drawn is that with practice a figure for K_3 may be determined which will give the absolute ceiling to within a sufficiently good margin of the actual. In a short time, the designer will have accumulated enough data to enable him to tabulate a range of values of K_3 representative of the particular class of aircraft in which he specialises, covering the aerodynamic changes which occur in a variety of his designs.

(To be continued.)

TECHNICAL LITERATURE

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS

These Reports are published by His Majesty's Stationery Office, London, and may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through any Bookseller.

WIND TUNNEL TESTS OF RECOMMENDATIONS FOR THE PREVENTION OF WING FLUTTER. By B. Lockspeiser, M.A., and C. Callen. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1464. (32 pages and 15 diagrams.) February, 1932. Price 1s. 9d. net.

The detailed theoretical investigation carried out by R. A. Frazer and W. J. Duncan,* on wing flutter, together with their wind tunnel experimental work on simplified aeroplane structures resulted in certain recommendations to designers for the purpose of eliminating flutter, or for raising the flutter speed beyond the terminal velocity of the aeroplane.

In the correlation of this theoretical work with practical application, it was thought desirable to test the recommendation, as far as is practicable, on a model wing structure and the present series of experiments were designed to that end. The possibility of reproducing and investigating the flutter of any aeroplane wing system, by testing a model of reduced rigidity in a wind tunnel, has already by experiments† been established on a scale model of the wing system of the single seater biplane. The wing system in this case was eminently suitable for testing the design recommendations, for flutter for this aeroplane was found to develop in flight at 180 m.p.h.—a figure well below the terminal velocity of about 260 m.p.h. The margin for improvement was therefore considerable.

The experiments carried out in the course of the present investigation, relate in the main to design recommendations concerning the aileron system and the results can be conveniently summarised as follows:—

Recommendation (a). Irreversibility of Aileron Control.—The flutter speed rises as the condition of irreversibility is approached. It appears to be important to achieve this maximum, as small departures from it lead to large reductions in flutter speed.

Recommendation (b). Centre of Gravity of Aileron Slightly Ahead of Hinge.—All the experimental evidence points to the conclusion that the location of the aileron C.G. ahead of the hinge is, failing recommendation (a), the most powerful means of preventing flutter. The present indications are that it is better to err in the direction of greater rather than less aileron overbalance.

Recommendation (c). Moment of Inertia of Aileron Small.—If recommendation (b) has been observed, the value of the moment of inertia does not appear to be of great importance. The flutter speed is high whether the moment of inertia be large or small.

If recommendations (b) and (c) are taken together, the experimental evidence is that (c) is relatively unimportant; if (c) be applied without (b), then the application of (c) may be harmful. It is suggested that recommendation (c) should read, "The moment of inertia of the aileron should be as small as possible consistent with the observance of (b)."

Recommendation (e). Aileron Heavily Damped (Artificially).—Heavy viscous damping applied at the cockpit produces only a small flutter speed rise of 6·5 per cent. Damping applied at the aileron hinges would, perhaps, make this recommendation more effective.

Recommendation (f). Aileron Definitely Underbalanced Aerodynamically.—The experimental evidence from aeroplane "H"‡ is that, with mass balanced ailerons, the most favourable position of the hinge axis for the avoidance of flutter is obtained when the aerodynamic underbalance is as small as possible.

Struts between Fuselage and Wing Tanks.—The effect of these struts is slight and not beneficial.

Variation in Position of Inter-aileron Strut.—The most favourable position for the inter-aileron strut is as close as possible to the plane of the interplane struts.

Mobility of Fuselage in Roll.—The flutter speed is much higher (238 m.p.h. full scale) for anti-symmetrical than for symmetrical flutter (158 m.p.h. full scale) and the smaller the fuselage moment of inertia the higher the anti-symmetrical flutter speed.

* R. & M. 1155. The Flutter of Aeroplane Wings.—Frazer and Duncan.
† R. & M. 1197. Wing Flutter Experiments upon a Model of a Single Seater Fighter.—W. G. A. Perring.
‡ R. & M. 1197. Wing Flutter Experiments upon a Model of a Single Seater Fighter.—W. G. A. Perring.

A FLIGHT PATH RECORDER SUITABLE FOR PERFORMANCE TESTING. By R. P. Alston, B.A., D. A. Jones, A.M.I.Ae.E., and E. T. Jones, M.Eng. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1471. (8 pages and 8 diagrams.) April, 1932. Price 9d. net.

A light instrument is required which can be easily fitted to any aeroplane other than single-seaters, and is capable of recording the speed and the direction of the flight path relative to the atmosphere, thus eliminating the errors due to vertical currents in aerodynamic experiments.

An instrument weighing under 11 lb. and suspended by a single cable was made and tested in flight. The record of the flight path angle was unsteady, and remained so in spite of modifications. Further experiments were made to determine the variation with time of the mean value of the recorded flight-path angle on an aeroplane with known characteristics.

The record of flight path angle, although oscillatory, is adequate to determine the mean angle over half a minute interval with an error not exceeding 0·25 deg. The instrument can be used in weather definitely unsuitable to the standard method, involving rate of change of aneroid height.

MEASUREMENT OF POSITION ERROR ON HIGH SPEED AIRCRAFT. By R. K. Cushing. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1472. (5 pages and 5 diagrams.) April, 1932. Price 6d. net.

During performance measurements of high speed aircraft at Calshot in 1931, the position error of the pitot static heads of several racing seaplanes was measured. Since no full scale data of this kind has previously been obtained at speeds much less than the full throttle level speeds the results are here recorded.

The measurements were made from top level speed to about 100 m.p.h. below it for the biplane, Gloster IVA, and for each of the monoplanes, Supermarine S.V and S.VI, and the Gloster VI.

The indicated airspeed given by the A.S.I. at top level speed is lower than the actual indicated airspeed for all the aircraft, the correction varying from 1½ to 19 m.p.h. The agreement with model results is fair.

GRAPHICAL SOLUTIONS FOR INVISCID FLOW. By H. F. Winny, Ph.D. Communicated by Dr. N. A. V. Piercy. R. & M. No. 1473. (16 pages and 4 diagrams.) April, 1932. Price 1s. net.

The use of inviscid flow solutions has long been appreciated in studying the flow past hulls of ships, but recently such solutions have again become prominent in several aeronautical connections as a consequence of the effects of viscosity being confined to a thin boundary layer of fluid at high Reynolds numbers. External to this layer the flow often approximates to inviscid form, as, for instance, past the front parts of bodies or past cylinders of thin streamlined sections. Calculation of even the inviscid motion, however, in general presents difficulties.

The report describes a method for obtaining by successive mechanical and graphical operations a double distribution appropriate to the inviscid flow past a cylinder of any thick section; by introducing a derived contour shape the method is made applicable to thin sections, such as aerofoils. The appendix contains an alternative method which is only applicable to thick sections. Some numerical examples are evaluated, and the accuracy of the results is investigated.

THE DISTRIBUTION OF TURBULENCE OVER THE CENTRAL REGION OF A PIPE. By A. Fage, A.R.C.Sc., and H. C. H. Townend, B.Sc. R. & M. No. 1474. (6 pages and 9 diagrams.) June, 1932. Price 6d. net.

Hitherto, nearly all the researches into the character of turbulent fluid flow have been concerned with the motions of relatively large molar masses of the fluid, and the methods used to obtain visual impressions of the flow pattern have involved the introduction into the fluid of particles of extraneous matter, such as aluminium particles, oildrops, etc. It was considered that such methods might not be suitable for the study of micro-turbulence especially near the boundary of the fluid where the scale of the turbulence is small, since the particles introduced might be comparable in size with the molar masses themselves, and then their internal motions would probably not be faithfully represented. In the earlier work, this uncertainty was eliminated by an examination with an ultra-microscope. The method used was such that no interference with the flow was involved, since neither extraneous particles nor measuring instruments were introduced into the fluid, as there were found to be suitable particles in ordinary tap water.

The results of a further examination with an ultra-microscope of turbulent flow in a pipe are given in the present paper. The principal feature of the present experiments is that the measurements were made at a much higher Reynolds number than in the earlier experiments.* The further evidence obtained supports the earlier conclusion that the maximum values of the three components of the disturbed velocity at a point on the axis have about the same magnitude. It is also shown that the region at the centre of a pipe over which the maximum values of the cross components of the disturbed velocity are approximately equal is extended with an increase in Reynolds number.

* An examination of turbulent flow with an ultra-microscope. A. Fage and H. C. H. Townend, Proc. Roy. Soc. A, Vol. 135, 1932.

AN ARITHMETICAL SOLUTION OF CERTAIN PROBLEMS IN STEADY VISCOUS FLOW. By A. Thom, D.Sc., Ph.D., Carnegie Teaching Fellow, University of Glasgow. Communicated by Prof. J. D. Cormack. R. & M. No. 1475. (6 pages and 3 diagrams.) May, 1932. Price 6d. net.

The author has elsewhere* given a method of solving arithmetically problems of steady two-dimensional viscous flow in an incompressible fluid. Here the method is extended to the special three-dimensional cases where the flow pattern in every plane radiating from a straight line is identical. Thus cases of flow in circular pipes of varying section or past solids of revolution can be dealt with. The method consists of successive improvements of an initial trial solution. If sufficient time is available, the approximation can be carried to any desired degree. It is, however, laborious even when a comptometer is available.

The example chosen to illustrate the application is that of the flow at a sudden enlargement of a circular pipe, this having a direct bearing on viscosity measurements. The diameter is assumed to increase to four times its initial value. It is suggested that the pressure loss at such an enlargement is practically the same as that which occurs when the smaller diameter pipe discharges through a plane wall into a relatively large vessel. The solution should, therefore, give the value of the end correction in capillary tube measurements of viscosity. The value actually found is in good agreement with that found experimentally by Bond.†

* Proc. Roy. Soc., A. Vol. 131, 1931, p. 30, or R. & M. 1194.
† Viscosity Determination by Means of Orifices and Short Tubes.—W. N. Bond. Proc. Phys. Soc., Vol. 34, p. 139, 1921-22.

SLOTTED R.A.F.34 BRISTOL FIGHTER. MEASUREMENT OF FORCES ON SLAT IN FLIGHT. By A. Ormerod, B.Sc. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1477. (6 pages and 30 diagrams.) May, 1932. Price 1s. net.

It was desired to measure full scale the forces acting on a slat in flight to provide data for stressing and estimating the action of auto-slots.

The full-scale part of a programme of pressure measurements on a slat, which was confined to such measurements as would provide a check on the model work, was begun in 1930 and completed in 1931. The results are collected here, but needed to be supplemented by model work.

A slat spanning the upper R.A.F.34 plane of a Bristol Fighter was used. Pressures were measured over two sections, one at mid semi-span and one near the wing tip, over a range of incidence from 7° to 27°. At the mid semi-span section, the greatest force coefficient of the slat, in terms of the speed of flight, was 2·35 at 27° main-wing incidence. The greatest coefficient at the tip section was 1·75.

EXPERIMENTS ON REDUCTION OF FIRE RISK BY MEANS OF INDUCTION PIPE FLAME TRAPS. By A. Swan, B.Sc., A.M.Inst.C.E.; Sqd. Ldr. W. Helmore, M.Sc., A.F.R.Ae.S.; W. C. Clothier, M.Sc., Wh.Sch. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1484. (16 pages and 15 diagrams.) August, 1932. Price 1s. net.

As an extension of the experiments carried out on flame extinction in gaseous mixtures (R. & M. 1266)* tests were made regarding various forms of cooling channels which might be built up in the form of a pack for insertion in an engine induction pipe. In the construction of a "cooling pack" for this purpose, apart from its efficiency as a flame extinguisher, it was necessary to consider the resistance to flow of petrol/air mixtures resulting from an obstruction of this kind in the induction pipe, and also the strength of the structure, having regard to its properties for resisting distortion, either due to temperature or to the violence of explosion.

Cooling packs capable of quenching the flame in petrol/air mixtures have been developed. By using a special construction of alternate sheets of flat and corrugated metal foil the resistance to flow has been reduced to a minimum without sacrificing mechanical strength.

With petrol/air mixtures it was observed that the atomisation of the petrol was considerably improved.

Experiments regarding the tendency of the flame trap to freeze showed that ice was only deposited on the flame trap when freezing occurred in the induction pipe, that is, when the temperature recorded by a thermometer exposed to the mixture stream was below 0° C. and water vapour was present in more than sufficient quantity to saturate the air at that temperature. In view of the fact that flame traps would preferably be used in conjunction with inside air intakes or on supercharged engines, no difficulty on this account is anticipated.

Tests on a multi-cylinder engine fitted with flame traps showed no appreciable loss of power at normal speed.

Continuous backfire of the most severe type at approximately 70 backfires per minute was withstood by the final form of trap for 10 hours without failure.

* R. & M. 1266. Experiments on Flame Extinction in Gaseous Mixtures.—Squadron Leader W. Helmore, M.Sc.

EFFECT OF FLOAT SETTING ON TAKE-OFF AND TOP SPEED OF THE III F. By J. L. Hutchinson, B.A. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1487. (2 pages and 1 diagram.) December, 1930. Price 3d. net.

The investigation was made to determine the float setting giving the best all-round performance in take-off, top speed and seaworthiness of the IIIF. with 6,300 lb. buoyancy floats. The times to take-off and the top speeds at 2,000 ft. were observed over a range of float angle from 3° to 8° measured relative to the root wing chord.

The take-off times varied considerably over the range covered; the quickest take-off was obtained with a float angle of 6° which is approximately the standard setting for the IIIF. Handling trials in rough water established that the seaworthiness was satisfactory for this position. There was no sensible variation in top speed at the different settings.

WIND TUNNEL DATA ON THE EFFECT OF SLIPSTREAM ON THE DOWNWASH AND VELOCITY AT THE TAILPLANE. By F. B. Bradfield, Math. and Nat. Sci. Triposes. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1488. (7 pages and 15 diagrams.) June, 1932. Price 9d. net.

A collection has been made of existing wind tunnel tests on the effect of the slipstream on the tailplane.

When there is no slipstream, the tail lies in the down-wash due to the wings, and the local velocity is slowed up by the interference of the body and wings. The effect of the slipstream is to increase the downwash angle, and to increase the velocity near the tail. The "effective" downwash angle ϵ is determined by finding the setting of the tail at which the normal force on the tailplane is zero: $\delta\epsilon$ is the difference caused by the slipstream in this angle. The "mean effective" velocity is defined as that uniform velocity which would give the same normal force on the tailplane. If this velocity be U without slipstream and U $(1 + b)$ with slipstream, then the tail efficiency is increased in the ratio $(1 + b)^2$ by the slipstream. The results of the wind tunnel tests* have been analysed to find δ, ϵ and b.

*R. & M. 882. "An Investigation of Downwash in the Slipstream." L. F. G. Simmons and E. Ower. R. & M. 1419. "Tests on Model of 'Wapiti,' including Effect of Slipstream." A. S. Hartshorn, D. M. Hirst and G. F. Midwood. R. & M. 1212. "Preliminary Tests of the Effect on the Lift of a Wing of the Position of the Airscrews Relative to it." F. B. Bradfield.

FIRST FATAL AUTOGIRO ACCIDENT

French pilot killed by taking the machine off with the fore-and-aft control locked in the position corresponding to best rotor angle for running-up on the ground.

IT is with the greatest regret that we have to place on record the death as a result of a flying accident last week of M. Pierre Martin, one of the Lioré & Olivier firm's test pilots. The accident occurred at Villacoublay aerodrome, while M. Martin was making his first solo flight on an autogiro similar to that exhibited at the Paris Aero Show recently.

Mr. de la Cierva himself carried out all the preliminary test flights on the new LeO "Autogiro," and was thoroughly pleased with the machine, which came fully up to his expectations both on the score of performance and in general handling qualities. Previous to the accident Mr. de la Cierva had taken M. Martin up as passenger, and had given him instructions in handling the machine. Not that Martin was quite a beginner. In fact, he had flown between 30 and 40 hours on "Autogiros" of different types. The actual machine on which the crash occurred had done some six hours of flying in the hands of Mr. de la Cierva. When he handed over the machine to M. Martin, he was quite satisfied not only with the machine, but with Martin's ability to handle it.

The take-off appeared a little unusual, the machine running along and seeming to gain unusually high speed on the ground. Finally it got into the air and reached a height of about 200 ft., apparently with the engine "full out." It then got into a slight dive and descended in that manner until it struck the ground, still with the engine running. M. Martin was thrown out and killed.

The first newspaper reports had it that one of the rotor blades broke while the machine was flying. This is untrue. There was nothing whatever wrong with the rotor, which kept running perfectly until the machine struck the ground.

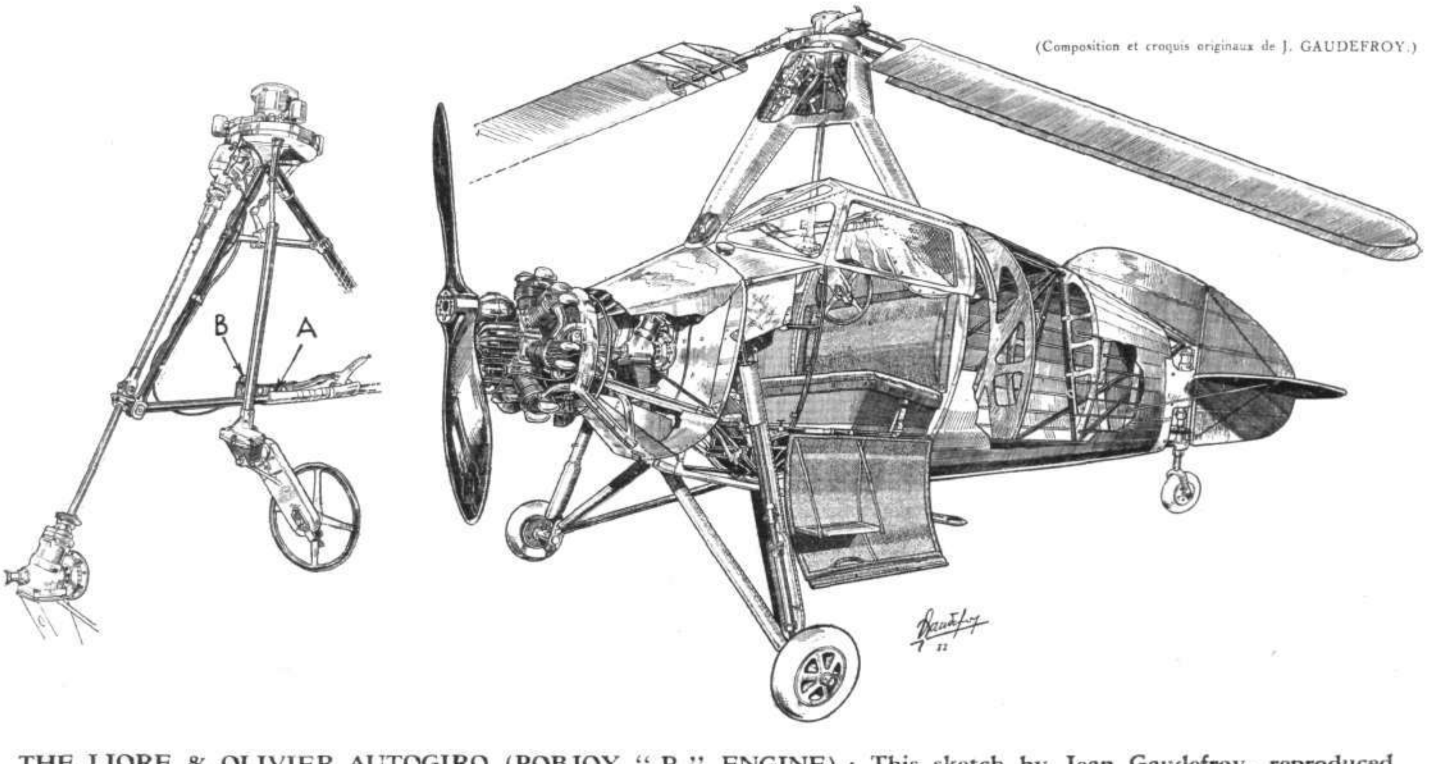
An examination of the wreckage revealed the fact that the fore-and-aft control was locked, although there were signs that the pilot had wrenched it slightly loose. There seems to be no doubt that the accident was due to the human element. The direct-control "Autogiro" built by Lioré & Olivier has the control column running down past the side of a curved rail, and a knurled knob is provided by means of which the control column can be locked in any fore-and-aft position. The arrangement is indicated in the sketch by Jean Gaudefroy, which we reproduce from the special Paris Aero Show number of our very excellent French contemporary *l'Aéronautique*.

When running up the rotor on the ground, it is customary to lock the fore-and-aft control in a certain position. This was done as usual before the fatal flight, but apparently M. Martin forgot to unlock it when he declutched the starter and began his run to take off. The result was that he took the machine into the air with his fore-and-aft controls locked, and was left with lateral control only (as far as the rotor is concerned) and, of course, rudder control, which is independent of the rotor.

It would seem that when he felt the machine behaving in a strange manner M. Martin lost his head to the extent of forgetting that he had the ready means of unlocking the fore-and-aft control. Instead he appears to have struggled with his wheel, trying by sheer force to pull the control back. The wreckage indicated that the control had been wrenched, and seemed to show that Martin had succeeded in moving the wheel a small distance, but it was not sufficient to flatten out, and the machine went into the ground at a slight diving angle.

Greatly as the death of a pilot of M. Martin's calibre is to be regretted, it is gratifying that nothing went wrong with the machine itself, and that there was no question of the rotor blades breaking in the air. An accident of this nature is probably not very likely to occur again, but it might be worth while to place a reminder in the cockpit of future machines.

In lamenting the death of a popular and skilful pilot, it is worth placing on record that in the whole history of evolution of the "Autogiro" this is the first fatal accident, a fact which speaks well for the general safety of this type of aircraft, and we are certain that when the full facts of the causes of this crash are generally known, the unfortunate occurrence will have no adverse effects on the future development of the type.



THE LIORE & OLIVIER AUTOGIRO (POBJOY "R" ENGINE) : This sketch by Jean Gaudefroy, reproduced by courtesy of our French contemporary "L'Aéronautique," shows most of the structural details. The fore-and-aft control is guided by the curved rail A, and can be locked in any position by the knurled knob B. It was through taking the machine off with the control locked that the fatal crash occurred.

From the Clubs

FALLING SAFELY : Mr. Raymond Quilter, who makes the " G-Q " parachute, especially designed for private owners, is here seen making a drop for test purposes, from one of the Brooklands Flying School " Moths." Note the left hand raised to adjust his goggles and the position of the body which will allow the chute to clear the legs. (FLIGHT *Photo*.)

BROOKLANDS

Instruction has been in full swing throughout the week and a good daily record has been maintained. In addition to regular pupils, such as Messrs. Bond, Wood, Frost, Mayer and Chizik, most of whom have been down almost daily, a number of others have been able to escape from the ties of business long enough to put in some hours. Mr. Thompson completed a successful first solo, and Mr. Opie is forging ahead towards his "A" licence. Mr. Bancroft, the chief engineer, has taken a course on Pobjoy engines and intends to make arrangements for the repair of such engines in Brooklands workshops. Col. Smith-Barry, one of the pioneers of scientific flying instruction has brought his machine over for repairs, and among other visitors have been Mr. Armstrong for Ireland and Mr. John Grierson, who recently flew to Moscow. On Sunday, members of 601 Squadron lunched in the Club. On Monday Mr. Raymond Quilter made a parachute drop for photographic purposes. [See above.—ED.]

B.A.T.S. in the Belfry

How often have we heard that the success of a club, be it an aero club or any other sort of club, lies very largely indeed in the success of its social side?

Even in flying clubs, where all the members may be assumed as having the common bond of flying interest to hold them together, there comes a time when flying matters are looked upon as " shop," and during the winter afternoons or on days when it is impossible to fly, there must be engendered an interest, other than flying, which will sustain the members' keenness for their club and thus prevent them running away to their own homes or to someone else's.

Brooklands—that is those, whose fatherly care for its *habitués* has become proverbial—know this as a truism, and they set about finding a sure and certain preventive for it. The gods were good to them, for one day Mr. and Mrs. Mollison came down there to make a film for British International Pictures. With them came Mr. A. B. Woods, a producer for that company. Now Capt. Duncan Davis, in as much as he is responsible for the success of Brooklands, lives by hunting, only instead of chasing the wily wombat or other poor inoffensive creature, he assiduously chases all those whom he thinks would be better off in the air than on the ground. He saw Mr. Woods, appraised him, and the hunt was on. It did not take long—it seldom does when Duncan gets on the scent—and before that picture had become history Mr. Woods had climbed in a " Moth " nearer to heaven than he had ever been before.

We all know that the Lord loveth a cheerful giver—it's an ill wind—and a long lane—(Stop it!—ED.) ; anyhow, Duncan was repaid for giving this new member his time and knowledge, and eventually turning him out a polished pilot—they always do that at Brooklands—for A. B. Woods proved to be, as Mr. Percy Bradley said on Monday, December 19, the Brooklands " Noel Coward." So the Brooklands Amateur Theatrical Society were taught to unfold their wings (Don't bats really have webbed feet?—ED.) that night.

Naturally they, and A. B. W., had put in an enormous amount of work before " The Day," but we hope that the applause they received amply repaid them and their director. They hardly constituted an *amateur* theatrical society, they were too polished. Their opening chorus was better than that of many provincial companies we have seen, while their finale was a perfect example of staging. The programme throughout was clever and admirably planned to bring out the strong points of the cast. Being amateurs they were naturally enthusiastic, and were one as good as another. We cannot name them all, but we would suggest that Bill and George be staged in their " All-in " act at all future air meetings. An open-air ring would give them more scope, and, in any case, the rest of the company ought to have a chance of seeing them. Let us hope the B.A.T.S. do not hang in their belfry too long, but give us another show before we are much older. Well, Brooklands have led the way, so maybe what Brooklands does to-day some other club may do to-morrow, why not?

CINQUE PORTS FLYING CLUB

In spite of high winds the Club seems to have been fairly busy ; Mr. Barker has qualified for his "A" licence and Com. Haynes has renewed his. Mr. Scott-Taggart has

returned to the Club with his machine, and among visitors have been *Heracles* on its way to Croydon, and Mr. Barr, of Brooklands Sales Department, on a "Puss Moth." There is an amusing story of one of the club's members who enthusiastically built a machine of his own, and, taking advantage of a quiet day, took it out for test; unfortunately, the fumes from the exhaust were directed into the carburetter air intakes, which necessitated, as soon as the engine was started, the speedy use of fire extinguishers.

READING AERO CLUB

The Reading Aero Club and School of Flying have just issued a little booklet describing the work done by them and the facilities they offer to those desirous of learning to fly. The Club possesses a delightful clubhouse containing a lounge, dining room, bedrooms and a fully-licensed bar; the subscription is a guinea for ordinary members and two guineas for flying members. The School has carefully picked instructors and Cirrus and Gipsy "Moths" of the latest design. The average pupil takes from 6 to 10 hr. dual instruction before going solo, which costs between £15 and £20. Courses may be taken for both "A" and "B" licences, solo flying costing from two guineas per hr. to £2 10s. per hr. The Sales Department of Phillips & Powis, Ltd., can supply any make of new aircraft and also have a good stock of second-hand machines. The aerodrome is of ample proportions and has excellent approaches; also it is easy to find.

OLD AERO ENGINES NEVER DIE

A famous statesman once rejoiced when out of office because "he occupied a position of greater freedom and less responsibility," which sentiment can also be applied to old aero engines. Through the generosity of one of its directors, the Redwing School of Aeronautics have recently acquired an old Rolls-Royce "Eagle VIII" engine, and an Armstrong-Siddeley "Jaguar," which should improve the minds of budding mechanics even though it dirties their fingers. Lawyers pass from the bar to the bench, but old aero engines pass from the air to the bench.

MESSENGERS' FLYING CLUB

Mr. H. F. Russell, manager in England of the Commercial Cable Co., and President and founder of the Club, is retiring at the end of the year. He made it possible for the Club to be established and has always assisted in every way. We are very glad that he will continue to take an interest in the Club after his retirement.

MAIDSTONE AERO CLUB

The Maidstone Aero Club have now seriously taken in hand the question of flying tuition for members and their friends, and the number now being taught under the careful guidance of the Chief Instructor, Mr. R. F. Bulstrode, is steadily increasing—Kent is becoming very "air-minded" and seems very anxious to take up the serious side of flying. New Year navigation classes have now been commenced, and all those interested, whether members or not, are welcomed. Classes are now being held for special tuition in ground engineering, cross-country and elementary and advanced navigation courses.

A great number of members and their friends took advantage of the fact that the Club was open throughout the whole of Christmas, and a very festive gathering was maintained throughout this period. The Children's Christmas Tree party was a great success, and Father Christmas, arriving in the Club's "Moth," has decided many future bird men and women.

The Club premises will be officially opened on Saturday, May 10, full particulars and details of which will be announced later.

LINCOLNSHIRE AERO CLUB

On Thursday, December 15, the Lincolnshire Aero Club held their first dance. This was a most successful function, attended by about 750 people, who all agreed that they had been given a most enjoyable evening. Among the distinguished people present were Miss Winifred Brown, Flt. Lt. R. Bentley, the Mayor and Mayoress of Grimsby, Mr. and Mrs. W. J. Womersley, J.P., M.P. (the Borough Member), and representatives from the Skegness, Leicester and Hull Aero Clubs. Fifty valuable prizes were presented by Miss W. Brown, including a 12-h.p. Riley car.

Lady Drogheda, who had promised to attend, wired regretting her inability to be present owing to the impending arrival of Mrs. Mollison. Messages of best wishes for the success of the dance and the future of the Club were received from the Hon. F. E. Guest on behalf of the Air League of the British Empire. Miss Winifred Brown, who was introduced to the gathering by the Mayor of Grimsby, made a most charming speech, in which she advised everyone to learn to fly and asked them all to help the Club as much as possible. Flt. Lt. Bentley also made a short but interesting speech in support of civil aviation, and the Lincolnshire Aero Club in particular. After the cabaret, Miss Winifred Brown was presented with a clock on which was mounted the Club's badge. The Committee responsible for the dance were Messrs. C. A. Byron Turner, J. Swaby, T. Hall Felton, L. S. Tindall, R. Lloyd and H. A. Baskcomb, Hon. Secretary.

MONOSPAR CARRIES BOURBON PRINCE : Seated on the right of Capt. R. Stocken in the Monospar above, is Prince Sixte de Bourbon-Parme, who, accompanied by Le Comte de Bearn (in rear seat), returned to Paris in this machine on December 22, after lecturing before the Royal Geographical Society in London. (FLIGHT *Photo.*)

Air Transport

A "DRAGON" IN SERVICE

ZONK ! Our photographer catches Amy in the act of wasting precious champagne. She excused her action by naming the first Hillman's Airways " Dragon "—*Maylands*. (FLIGHT *Photo*.)

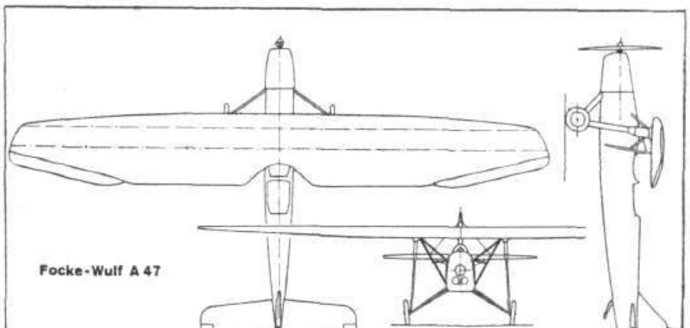
On Tuesday, December 20, Mrs. J. A. Mollison christened the first de Havilland " Dragon " (two " Gipsy Majors ") on the aerodrome of Mr. Edward Hillman, naming the machine *Maylands*. This aircraft, which was very fully described in FLIGHT for December 22, is one of three which is being added to Mr. Hillman's fleet for the operation of inland services in this country and for organised air tours. As our readers know, Mr. Hillman is comparatively a new comer to the industry, who established an aerodrome at Maylands during the year. He is a man of great foresight and courage, qualities which have been well proven by the amazing success he has had in building up one of the largest fleets of privately-owned motor coaches in the country. These qualities will undoubtedly carry him far with the aeronautical side of his business, and the success he has already had proves that his faith in the future is justified. We had the pleasure of a short flight in the " Dragon " on this occasion, and were very favourably impressed with the comfort afforded. It is definitely quieter than a " Puss Moth " and very comfortable indeed. In whatever part of the cabin the passengers sit, they get a reasonably good view, in fact, better than one would at first imagine possible, bearing in mind the twin-engined arrangement. The cabin is so quiet that speech is quite possible without raising the voice unduly, while the upholstery of the inside should prove as durable as it is comfortable and practical. Adequate arrangements are provided for the introduction of fresh air and also for keeping the cabin warm. From the pilot's point of view the " Dragon " must be considered an excellent machine for commercial purposes. The outlook is unrestricted in all directions, and, in fact, cannot be better, while Mr. H. Woods, the chief pilot of Hillman's Airways, told us that he finds the " Dragon " admirable to fly. From a maintenance point of view it is also very accessible.

TRULY COMMERCIAL : This, the first D.H. " Dragon," has been added to the fleet of machines used by Mr. Hillman at his aerodrome at Romford. Its capacious cabin should make it a paying proposition for commercial operation. (FLIGHT *Photo*.)

FOR METEOROLOGICAL OBSERVATIONS

The Focke-Wulf A.47

DESIGNED specifically for meteorological observations, the Focke-Wulf monoplane shown here is not a high-performance machine, but an endeavour has been made to make it very stable, so that when much cloud-flying has to be done, as must often be the case, the machine is easy to fly "blind." Good climb and a high ceiling were considered more important than speed, and in fact a high speed was regarded as a definite disadvantage, since it might, on occasion, lead to the machine getting too far away from its starting point during an altitude flight in the clouds.



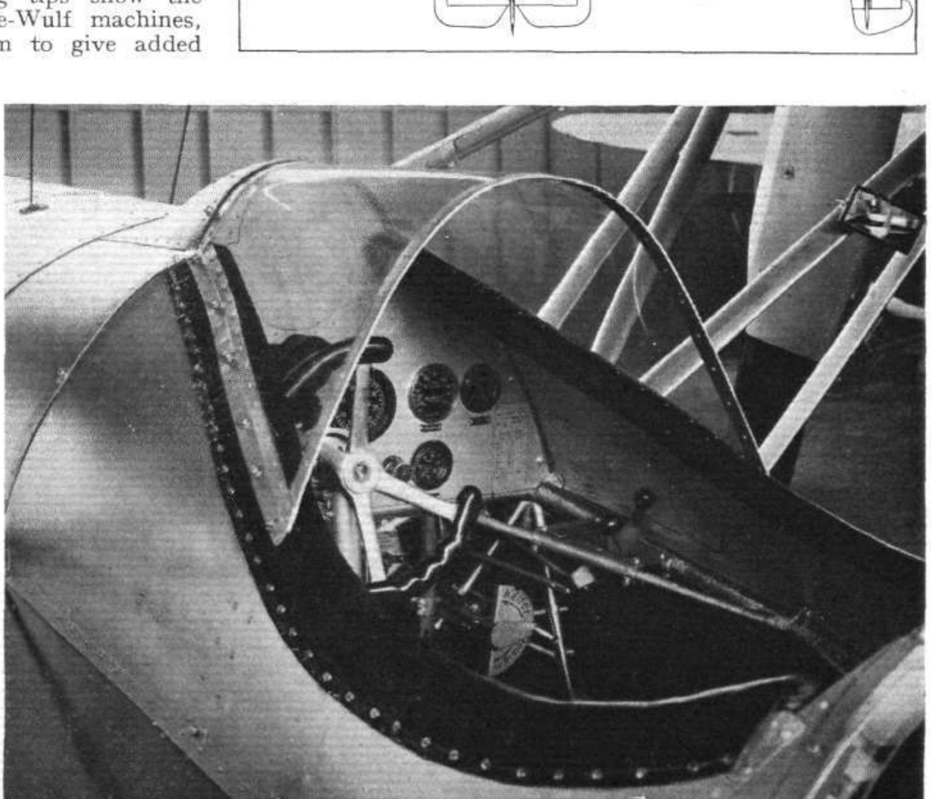
The construction of the A.47 is the usual Focke-Wulf, with a one-piece wing of all-wood construction, and a welded steel tube fuselage. The wing tips show the Zanonia form associated with all Focke-Wulf machines, and which has been found by this firm to give added lateral stability. The wing is carried on steel tube pyramids well above the fuselage.

The engine fitted in the A.47 is the new Argus As.10, an eight-cylinder Vee inverted air cooled, with direct airscrew drive. Later it is proposed to fit a supercharged engine of the same make.

An unusually extensive equipment of instruments is carried, partly for making meteorological observations, and partly to enable the crew to fly "blind" for considerable periods.

The main dimensions of the Focke-Wulf A.47 are as follows: Length o.a., **10.5** m. (34 ft. **6** in.); wing span, **17.76** m. (58 ft. 3 in.); wing area, **35** m.² (377 sq. ft.). The tare weight is **950** kg. (2,090 lb.), and the disposable load **525** kg. (1,155 lb.), giving a gross weight of **1,476** kg. (**3,245** lb.), a wing loading of **42,2** kg./m.² (8,62 lb./sq. ft.) and a power loading of **6.7** kg./h.p. (14.75 lb./h.p.).

The maximum speed at ground level is **172** km./h. (**107** m.p.h.), and the landing speed **77** km./h. (**48** m.p.h.). The climb to **4,000** m. (13,100 ft.) takes **34** minutes. The best gliding angle is given as **1** in **10.8**.

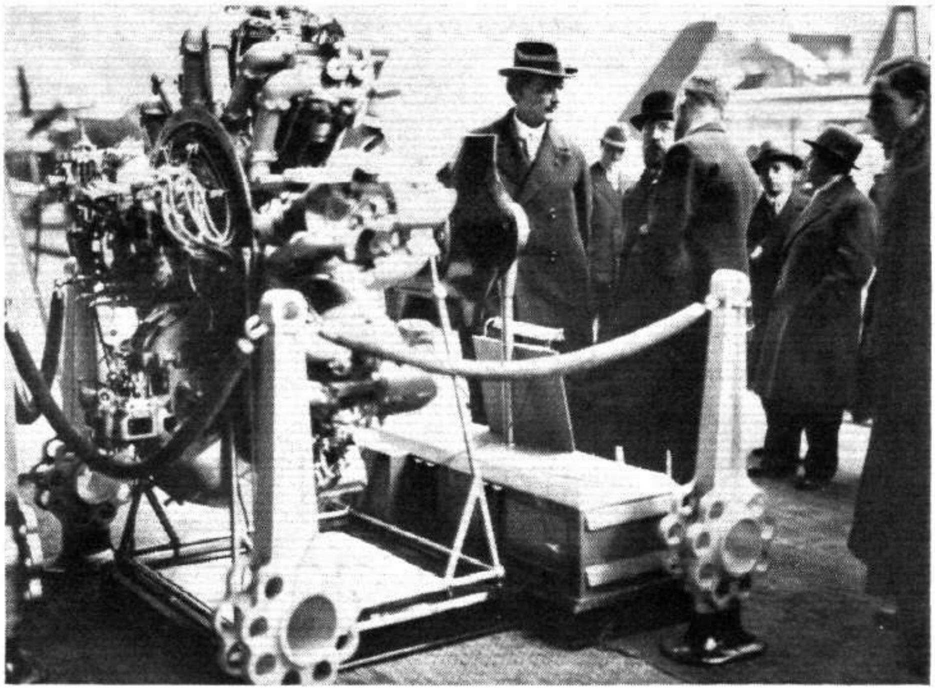


THE PILOT'S COCKPIT: The instrument equipment is unusually extensive. Below and to the right of the wheel can be seen the oil temperature control handle.

Airisms from the Four Winds

Mr. Mollison to Attempt South Atlantic Flight

It is reported that Mr. Mollison hopes to leave Portmarnock, near Dublin, at the beginning of February, on a flight to Rio de Janeiro; he may fly non-stop to Dakar in French West Africa and from there across the Southern Atlantic to Brazil, the "Puss Moth" *Heart's Content,* fitted with a new "Gipsy Major" engine, will probably be used. Mr. and Mrs. Mollison left London on December 22 by air for Switzerland; they had apparently booked two seats on an Imperial Airways machine, but, arriving seven minutes late, found that Imperial Airways, like time and tide, wait for no man—punctuality is the soul of business. Mr. and Mrs. Mollison then chartered a French machine and flew to Paris. (There is a popular supposition that British machines can also be chartered at Croydon.)



ALTITUDE RECORD HOLDERS AT THE PARIS AERO SHOW: Prof. Piccard, the holder of the world balloon altitude record, and the Bristol "Pegasus" engine, which was fitted in the Vickers "Vespa" on which Flt. Lt. Uwins attained the world aeroplane altitude record.

R.A.F. Flight over Himalayas

Five Service machines, standard "Harts" with Rolls-Royce "Kestrel" engines, under the command of Flt. Lt. F. H. Isaac of No. 39 Bomber Squadron, Risalpur, recently made a flight over hitherto inaccessible country in the Himalayas during which many fine photographs were taken. During this exceptionally fine flight, Mount Rakaposhi, 25,550 ft. high, was flown over, and it is interesting to note that Mount Everest is only 3,400 ft. higher. For a formation of five machines of service type to fly at such a height for several hours, and over country of such a rugged nature, is no mean achievement, and the pilots concerned are to be congratulated on the successful termination of the venture. If service pilots in service machines can reach a height of over 25,000 ft., the specially prepared machines of the Everest Expedition should have no difficulty in flying up to 29,000 ft. No. 39 Squadron might well add to their motto of "by day and by night" the words "over all mountains and plains."

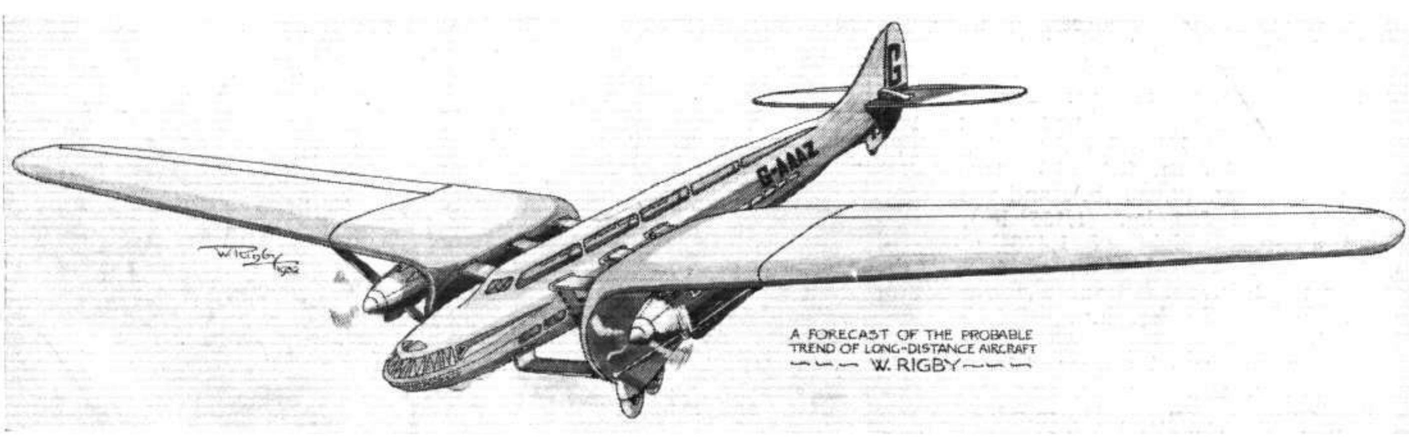
Leader of Air Everest Expedition

Air Commodore P. F. M. Fellowes, D.S.O., has been appointed leader of the Everest expedition, which will leave England early next year. Air Commodore Fellowes has had a long and distinguished flying career, and since the war has done much service abroad, including a tour in Persia, during which he was engaged in setting up aerodromes in mountainous country; he has also in the past flown low over mountains in South Africa and in Persia to test the air currents. As was reported in Flight on December 8, the machines to be used are Westland aircraft—the "P.V.3" fitted with a "Pegasus" engine, and one of a type used by the R.A.F. ("Wapiti"?).

It may be of interest to note that the "Ground" Everest Expedition of the Royal Geographical Society has invited Mr. T. Brocklebank, the Cambridge rowing blue, and Mr. Wager, who was a member of the Arctic Air Route Expedition of 1930-31, to join in the new assault on Mount Everest.

The Prince Flies to School

The Prince of Wales flew, on December 20, in his "Puss Moth," from Sunningdale to Longford Castle, Salisbury, where he visited the Odstock School and spoke to the boys.



FOR 1933? Mr. W. Rigby (whose paper flying models will be much in the air this Christmas) has visualised the commercial machine of the future as shown above. Among the special features are: tandem engines arranged either side of the fuselage and shielded from the latter by the "arched" wing roots; a "fresh-air" promenade on top of fuselage; water propellers under tail to enable machine (wings having been discarded) to taxi in event of forced landing on water.

THE ROYAL AIR FORCE

London Gazette, December 20, 1932.

General Duties Branch

ot Officer on probation R. Sorel-Cameron is confirmed in rank (Dec. 9). follg. Pilot Officers are promoted to rank of Flying Officer:—G. V. er (Nov. 5); G. F. Wood (Nov. 6); O. P. E. Williams (Nov. 18).

ying Officer E. A. Kayser takes rank and precedence as if his appointment ying Officer bore date Feb. 28, immediately following F/O. A. R. Collins on ation list. Reduction takes effect from Nov. 28; Group Capt. D. C. S. , D.S.C., A.F.C., is placed on half-pay list, Scale A, from Nov. 19 to 28, inclusive.

e follg. cease to be attached to R.A.F. on return to Naval duty:—. dr. J. F. M. Robertson, R.N., Flying Officer, R.A.F. (Dec. 12); Lt.-Cdr. . Lea, R.N., Flying Officer, R.A.F. (Dec. 19).

ng Commander R. G. D. Small is placed on retired list on account of alth (Dec. 17); Flt. Lt. D. Drover is placed on retired list on account of alth (Dec. 21); Flying Officer G. Wood is transferred to Reserve, Class A 16); Flt. Lt. C. N. C. Dickson, A.F.C., is transferred to Reserve, Class ec. 18). *Gazette*, Oct. 18, concerning Lt. J. H. Charsley, R.N., Flying er, R.A.F., is cancelled.

Stores Branch

Squadron Leader L. A. Lavender is placed on retired list (Dec. 19); Flt. Lt. T. J. Organ is placed on retired list (Dec. 19).

Medical Branch

Flt. Lt. N. M. Jerram, M.R.C.S., L.R.C.P., is placed on retired list on account of ill-health (Dec. 21).

Chaplains Branch

The Rev. J. R. Appleyard is granted a permanent commn. (Dec. 21).

ROYAL AIR FORCE RESERVE

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

Flight Lieutenant D. S. Green is transferred from Class A to Class C (Nov. 29). The follg. Flying Officers relinquish their commns. on completion of service:—A. D. McC. Blair, T. E. Greenough (Dec. 16). The follg. Flying Officers relinquish their commns. on completion of service and are permitted to retain their rank:—E. F. D. Gregory, M. A. Vachon (Dec. 16).

SPECIAL RESERVE

General Duties Branch

Pilot Officer R. H. Watson is promoted to rank of Flying Officer (Dec. 9).

ROYAL AIR FORCE INTELLIGENCE

ppointmen... The following appointments in the Royzl Air Force are ...d:—

General Duties Branch

uadron Leader: B. E. Baker, D.S.O., M.C., A.F.C., to R.A.F. Training Leuchars, 12.12.32, for flying (Chief Flying Instructor) duties, vice dr. A. Lees, A.F.C. R. S. Aitken, M.C., A.F.C., to H.Q., Air Defence . Britain, Uxbridge, 12.12.32, for duty as Chief Signal Officer, vice W./Cdr. . Nutting, O.B.E., D.S.C. D. L. Blackford, to No. 32 (F) Sqdn., Biggin 12.12.32, to command vice S./Ldr. B. E. Baker, D.S.O., M.C., A.F.C.

ght Lieutenants: J. L. Kirby to No. 70 (B.T.) Sqdn., Hinaidi, Iraq, 32. F. W. Long to H.Q., Aden Command, 14.11.32. T. J. Desmond . 45 (B) Sqdn., Helwan, 25.11.32. F. E. Vernon, to No. 462 (F.T.B.) t, 12.11.32. T. B. Bruce, M.C., to Aircraft Depot, Karachi, India, 32. W. J. E. Lindley, to No. 11 (B) Sqdn., Risalpur, India, 10.12.32. . Thompson, to H.Q., Iraq Command, 9.12.32. E. G. C. Stokes, to ft Depot, Karachi, India, 17.11.32. J. Marson, to Aircraft Depot, di, Iraq, 9.12.32. L. E. Dowse, to No. 216 (B.T.) Sqdn., Heliopolis, , 9.12.32.

Flying Officers: A. G. M. Cary to Aircraft Depot, Hinaidi, Iraq, 14.11.32. V. A. Dawson to No. 101 (B) Sqdn., Andover, 7.12.32. J. W. Bateman, to No. 202 (F.B.) Sqdn, 10.12.32.

Pilot Officer: A. Moncrieff to No. 39 (B) Sqdn., Risalpur, India, 2.11.32.

Stores Branch

Flight Lieutenant T. G. Bowler, to R.A.F. Depot, Middle East, Aboukir, 9.12.32.

Accountant Branch

Wing Commander P. J. Wiseman, to Station H.Q., Hinaidi, Iraq, 9.12.32, for Accountant Duties.

Squadron Leader P. Hay, M.C., to Aircraft Depot, Hinaidi, Iraq, 9.12.32, for Accountant Duties.

Medical Branch

Wing Commander R. S. Overton to No. 21 Group H.Q., West Drayton, 12.12.32. for duty as Sen. Medical Officer.

Flight Lieutenants: R. W. White to No. 31 (A.C.) Sqdn., Quetta, India, 3.11.32. A. Harvey to No. 20 (A.C.) Sqdn., Peshawar, India, 31.10.32.

...TRICAL AND WIRELESS SCHOOL, CRANWELL

following are extracts from the report by the Commanding Officer, -Capt. R. A. Verney, O.B.E., at the passing out inspection of Aircraft ntices, on December 22. The inspecting officer was Air Vice-Marshal . I. Webb-Bowen, K.C.B., etc.

e original strength of the entry on arrival at the school was 60, divided for ng into 40 Wireless Operator Mechanics and 20 Electricians. The ving changes have occurred:—(*a*) *Wireless Operator Mechanics.*—Five discharged, one by purchase, three unfit for Service training, one for al reasons. In addition, one was transferred to the Electricians. esulting total of W.O.M's. passing out is 34. (*b*) *Electricians.*—The total was increased by one transferred from the Wireless Operator Mechanics, one from the September, 1929, entry. Of these, three died, and one discharged on medical grounds, leaving a total of 18. The total entry erefore 52, comprising 34 Wireless Operator Mechanics and 18 Elec- ns.

scipline.—I have noted a considerable improvement since my last report; sider that slackness as regards the regulations about smoking and the ing of officers has diminished, but further improvement in steadiness rade and when marching at attention is needed.

aining.—The standard of technical knowledge attained by both trades is Entry is equal to that of previous entries; their ability in workshop ice is above the average. The results obtained in the Final C.T.T.B. aination are average. The 34 Wireless Operator Mechanics passed s follows: 5 L.A.Cs., 21 A.C.1's., 8 A.C.2s. Electricians: 2 L.A.Cs., .1s., 7 A.C.2s.

ring the latter part of the term a considerable reorganisation of instruc- has been necessary consequent on the Air Ministry decision to alter ualifications of the various signals trades and the responsibilities of the s tradesmen. The new Air Ministry policy has not yet been brought he service, but the extended training of two months which is being given 34 Wireless Operator Mechanics will enable them to undertake the new sibilities of their trade when the new policy is implemented. With a bject the 18 Electricians should therefore endeavour to extend the edge they have obtained towards acquiring a knowledge of radio ples and Morse Code, or they should direct it towards the reinstated of Instrument Maker, in which their knowledge of electricity will not sted, remembering, however, that skill of hand is of primary importance s trade.

cation.—The standard of this Entry has been well up to that of their predecessors. The average marks obtained was 61·5 per cent., an vement on the figure of 58·7 per cent. of the preceding Entry and closer 60 and 62 per cent. of the two earlier Entries. Further, the general ge of the educational standard has been higher; for while only three dates succeeded in obtaining more than 70 per cent. (two of these with distinction with more than 75 per cent.), only two apprentices assing out obtained less than 50 per cent., and thus failed to qualify tionally for L.A.C. This is a good result.

eral.—In addition to the 410 aircraft apprentices there are 10 officers 79 airmen under training in this school. The 13th course of 9 officers w approximately half way through their training.

mes and Sports. Association Football.—The Squadron have so far d 9 games, of which 3 have been won. *Rugby Football.*—The Squadron so far played ... games, of which 2 have been won. *Hockey.*—The Squadron played 8 games 5 having been won. *Swimming.*—The Squadron supplied of the 11 in the Command Team in the R.A.F. Championships at Halton gust. *Cross-Country.*—So far this season three Aircraft Apprentices un in Command teams. *Higgins Shield Competition.*—This competition on September 30, the Squadron average being 43·24 per cent. This improvement of nearly 5 per cent. on last year's results. 20 aircraft ntices completed the nine events. *Boxing.*—Three A./Apps. were ed to represent the Command in the Wakefield Competition. The s were as follows: A./App. Warren won Bantam weight competition; pp. Sales was runner-up in the Middle-weight Competition.

Prizes.—The winner of all three Air Ministry Prizes, the Highest Aggregate for the highest marks in all subjects, the Highest Technical and the Highest Educational Prize, is Leading Apprentice R. Foicik.

HALTON

The following are extracts from the Report by Air Vice-Marshal N. MacEwen, C.M.G., D.S.O., Air Officer Commanding, Royal Air Force, Halton, upon the occasion of the passing-out of the 21st Entry of aircraft apprentices of No. 1 School of Technical Training, on December 21. The inspecting officer was Air Marshal Sir Edward Ellington, K.C.B., etc.

Of the 461 boys originally attested, 60 were posted to the Electrical and Wireless School, 6 were granted discharge by purchase, 1 was granted discharge on compassionate grounds, 3 were discharged as "Unlikely to become efficient airmen," 12 were discharged on medical grounds, 1 was remustered to Aircrafthand, 2 died, 14 were transferred to junior entries, and 39 were transferred from senior entries, leaving 401 to pass out. These have been trained as follows: fitter aero engine 173, metal rigger 166, fitter armourer 48, and coppersmith and sheet metal worker 14. As a result of the final examinations:—38 aircraft apprentices, representing 9·5 per cent. of the entry, have been classified as Leading Aircraftmen; 265, representing 66·1 per cent. of the entry, have been classified as Aircraftmen, 1st Class; 87, representing 21·7 per cent. of the entry have been classified as Aircraftmen, 2nd Class; no aircraft apprentice failed to qualify; 11 were not examined owing to sickness.

Fitter Aero Engine.—The standard of skill achieved by the apprentices of this trade in basic fitting is of a high order. Engine instruction has been carried out on the Lion, Jaguar and Jupiter engines, while the mechanical transport instruction has been given on the Morris six-wheeled vehicle.

Metal Riggers.—I am happy to be able to say this morning that the result achieved at the final examination is well up to average.

Fitter's Armourer.—Fifty apprentices of this entry began training as Fitter's Armourer. Two became casualties during the three years, leaving a total of 48 to pass out.

They have shown keenness throughout their training. The general standard of efficiency compares favourably with previous entries, especially in fitting, where a high level has been attained.

Coppersmiths and Sheet Metal Workers.—The coppersmiths of the entry have reached a very high standard of skill in fashioning the different materials they are called upon to work.

Educational Training.—As a result of the final educational examination, 20 gained the distinction of obtaining 75 per cent. or more of the total number of marks; in addition to these, 287 obtained exemption from the examination for Leading Aircraftman, by obtaining over 50 but under 75 per cent., while 95 failed to obtain 50 per cent. of the total number of marks.

Health.—The health of the entry has been very satisfactory. No serious outbreak of infectious disease has occurred. The sickness incidence from all causes is below the average.

Awards.—The following is a list of the awards:—*1st Prize*: Sgt.-App. Matthews, Leslie Robert, Fitter, A.E. *2nd Prize*: L.A./App. Bicknell, Leslie Charles, Met. Rigger. *3rd Prize*: L.A./App. Duffy, Maurice James, Met. Rigger. *1st Fitter, A.E.*: A./App. Hadfield, Gilbert Ratcliffe. *1st Metal Rigger*: L.A./App. Duffy, Maurice James. *1st Coppersmith and Fitter Armourer (Combined)*: A./App. Watkins, Reginald Bennett, Coppersmith and S.M. Worker. *1st Educational Subjects*: L.A./App. Bicknell, Leslie Charles, Met. Rig.

Cadetships.—Cadetships have been awarded to:—L.A./App. Bickne... Leslie Charles; A./App. Vickery, Herbert Charles; A./App. Whillier, A... A./App. Rose, L.

Lord Wakefield Scholarships.—Lord Wakefield Scholarships have b... awarded to: L.A./App. Bicknell, Leslie Charles; A./App. Vickery, He... Charles.

Elliott Memorial Prize.—The Elliott Memorial Prize has been award... Sgt./App. Matthews, Leslie Robert, Fitter, A.E.

Correspondence

The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.

LANDING SPEED OF AIRCRAFT

[**2814**] May I add again to the discussion on the landing speed of aeroplanes?

Mr. Rennie in his letter did state the essential fact: the position of the pitot tube in relation to the aeroplane. There are few places where no effect is felt on the working of the A.S.I., particularly at high angles. Naturally, the pilot will land his plane at the indicated stalling speed—if he bothers to look at the instrument at all; if the plane stalls at **50** m.p.h. but the A.S.I. shows 30 m.p.h.—say—he will not go and try to land at **50** m.p.h. on the instrument. Some manufacturers—very unwisely to my mind—take advantage of this fact by taking that reading as the stalling speed. Now motor car manufacturers do happen to be so foolish as to gear up their speedometers and to market **80**-m.p.h. (indicated) cars, but none of the really serious constructors go in for this sort of eyewash.

The reason, of course, why firms advertise the most impossibly low landing speeds is that everybody is dead scared of a fast-landing aeroplane. But the matter of control at the stall is not necessarily more easily solved in a slow machine than in a heavily loaded one. And to make a practice of giving ridiculously low landing speeds would not appear to do anybody any good. It is not the true horizontal speed along the ground, in fact, it is merely a reading. To call this the stalling speed is just as absurd as to weigh the machine in kilogrammes and call the result pounds. Recently I made out a rather amusing list of various machines with landing speeds as given by the manufacturers and those likely to happen. The planes were selected quite at random from "All the World's Aircraft," and the probable landing speeds calculated. Allowing for thick, medium and thin sections (also curves in Warner's "Airplane Design"), out of 32 European machines two figures appeared improbable, *i.e.*, over **10** m.p.h. higher than the calculated values. Taking a difference of **10** m.p.h. and more as unlikely to be true, ***fifteen*** out of 40 American machines found a place on the black list.

In one instance—the worst—the landing speed with a wing loading of **6** lb. per sq. ft. was given as 26 m.p.h., thin section, no slots, flaps, or Autogiro vanes either ($K_{L_{max}}$ 1·74···). Some people seem to have access to wing sections seen in some designers' dreams.

The point is: Am I wrong or are they?

J. van Hattum.

The Hague, December 1, 1932.

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Calendars for 1933

In good time for the coming year a batch of calendars are to hand, covering almost every requirement an office or business house can demand. The Blackburn Aeroplane & Motor Co., Ltd., send one of their charming wall calendars, depicting in half-tone one of their Torpedo Bombers. From the Williams Manufacturing Co., Ltd., Bush House, makers of the Eagle aircraft cameras, comes another wall calendar, depicting "The Mountains of the Moon," whilst prominence is given in another from the Bristol Aeroplane Co., Ltd., to that company's world-famous engines and machines. Amongst desk calendars the usual model is to hand from The United Steel Co., Ltd., of Sheffield. This, although very plain in its get-up, is essentially practical and useful, and gives the full years' calendars for **1932-33** and **1934**. King's Patent Agency, Ltd., 146a, Queen Victoria Street, E.C.4, is also a useful publication, and, moreover, amongst other information, gives special data and a useful table of parcel charges (by weight) per railway. Pocket diaries are chosen by many firms, Imperial Airways being a leader in this form, Cellon, Ltd., of Kingston-on-Thames, also selecting one, handy and sufficiently small to suit the waistcoat pocket, whilst exceptionally elaborate in its contents is another to hand in *Motor Cycling*, a feature being made therein of a set of coloured road maps on a midget scale, a receptacle for season tickets, etc. Messrs. Adlard & Son, Ltd., Street, W.C.1, remind us of their facilities for pri on a very acceptable plan.

S. G. Brown, Ltd.

Mr. S. G. Brown, F.R.S., M.I.E.E., the well-k inventor of many patents in connection with gyro navigational instruments for air, land and sea travel also the wireless industry, placed his company, Brown, Ltd., into voluntary liquidation in September partly owing to the serious illness of Mrs. Alice Br a director and secretary, and other unforeseen diffic This action was decided upon as the only means wh Mr. and Mrs. Brown could concentrate on the excl manufacture of special devices amongst the former's i tions (including aircraft instruments), and on a s scale. The large works in North Acton, were va except for a small section where production is no progress. The company's address is Victoria Road Acton, W.3.

Air Filters for Aero Engines

C. G. Vokes, Ltd., of 95, Lower Richmond S.W.15, have recently supplied to Sir W. Arms Whitworth Aircraft, Ltd., air filters of improved d These filters are egg-shaped, the walls being of thin forated metal inside which is a five-ply layer of corru wire gauze and crude muslin; the filter is fitted to carburetter air inlet and the five-ply layer of wire muslin is soaked in oil through which the air passes b entering the carburetter itself. The filter weighs 7 lb. this could be reduced by constructing it of lighter m Such filters have been fitted to car engines for some but it is interesting to note that Armstrong Whitw consider them a necessary fitting for an aero engine; should prove very useful abroad where machines op from sandy aerodromes and particles of dirt and dus blown all over an engine every time it is run up. matter of fact service pilots in the Middle East and commands have frequently, in the past, used air filt crude, and entirely unauthorised design, to protec carburetters of their engines.

Air Service Training and Christmas

Air Service Training, Ltd. (Hamble), closed for the Christmas holidays on December 21, and reopen on January 6, 1933.

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PUBLICATIONS RECEIVED

L'Année Aéronautique, 1931–1932. By L. Hirschauer and Ch. D Dunod, 92, Rue Bonaparte, Paris.

The Hawk. The Journal of the Royal Air Force Staff College. Royal Air Force Staff College, Andover, Hants. Price 3s.

Reading Aero Club and School of Flying. The Reading Aero Club, Wo Berks.

Bulletin du Service Technique de l'Aéronautique: No. 12. *R d'essais au tunnel*. August, 1932. No. 13. *Notes et abaques sur la matique des moteurs en étoile*. By J. Ducarme. Oct., 1932. Service nique de l'Aéronautique, Rhode-Saint-Genèse, Brussels, Belgium.

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NEW COMPANIES REGISTERED

A. D. C. ENGINES, LTD.—Capital, £1,000 in £1 shares. Manufa and dealers in aeroplane and aeronautical engines, etc. Subscriber with one share) are:—Lt.-Col. M. O. Darby, Rose Walk, Purley, and J. B. Lennard, 234, Kew Road, Kew. Solicitors: Steadman Van and Gaylor, 4, Old Burlington Street, W.1.

SOUTHEND-ON-SEA FLYING SERVICES, LTD.—Capital, £1 £1 shares. Business: air passenger and goods transport company. Dir G. E. Weber, 7, Grosvenor Road, Westcliff-on-Sea, engineer; G. J. 24, South View Drive, Westcliff-on-Sea.

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AERONAUTICAL PATENT SPECIFICATION

Abbreviations: Cyl. = cylinder; i.c. = internal combustion; m. = m

(The numbers in brackets are those under which the Specification be printed and abridged, etc.)

APPLIED FOR IN 1931

Published December 29, 1932.

16,659. H. R. Ricardo. Combustion method in engines of the liqu injection compression-ignition type. (384,310.)

32,525. A. V. Roe & Co., Ltd., R. H. Dobson, and L. Leech. Va pitch propellers. (384,424.)

APPLIED FOR IN 1932

Published December 29, 1932.

3,384. Soc. Rateau. Utilization in a turbine of exhaust gases fr engine. (384,472.)

10,272. J. Haw. Metal screw-propellers. (384,523.)

10,437. H. Hirth, R. Weis and A. Hirth Akt.-Ges. Screw-pro (384,526.)

17,661. J. Squires. Hollow steel screw-propeller blades and their ma ture. (384,320.)

17,737. E. G. Budd Mfg. Co. Aerofoils. (384,587.)